

DOCUMENT RESUME

ED 279 801

CE 046 460

TITLE Learning Activity Packets for Grinding Machines. Unit I--Grinding Machines.

INSTITUTION Oklahoma State Board of Vocational and Technical Education, Stillwater. Curriculum and Instructional Materials Center.

PUB DATE [83]

NOTE 102p.; For related teacher's guide and packets, see CE 046 459-462.

AVAILABLE FROM Curriculum and Instructional Materials Center, Oklahoma State Board of Vocational and Technical Education, 1500 West Seventh Avenue, Stillwater, OK 74074 (Order No. TI 0312--\$6.00).

PUB TYPE Guides - Classroom Use - Materials (For Learner) (051)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.

DESCRIPTORS Adult Education; Job Skills; Learning Activities; *Machine Tool Operators; *Machine Tools; Postsecondary Education; Pretests Posttests; *Safety; Secondary Education; *Trade and Industrial Education

IDENTIFIERS Oklahoma

ABSTRACT

This learning activity packet (LAP) is one of three that accompany the curriculum guide on grinding machines. It outlines the study activities and performance tasks for the first unit of this curriculum guide. Its purpose is to aid the student in attaining a working knowledge of this area of training and in achieving a skilled or moderately skilled competency level in the performance of jobs associated with this specialty. The course of study in this LAP will help the student become able to identify types of grinding machines, to name the basic parts of the surface and cylindrical grinder, and to state the safety rules for operating grinding machines. Five tasks are included in the LAP. Contents are a check list of the learning steps, pretest, assignment sheets, and answer keys for the pretest and assignment sheets. (YLB)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

ED279801

CE046460

LAP NO

CODE

U.S. DEPARTMENT OF EDUCATION Office of Educational Research and Improvement EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) ☒ This document has been reproduced as received from the person or organization originating it. ☐ Minor changes have been made to improve reproduction quality. • Points of view or opinions stated in this docu- ment do not necessarily represent official OERI position or policy. "PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY <u>W. J. H. R. R.</u> TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."	State Department of Vocational and Technical Education CIMC Stillwater, Oklahoma LEARNING ACTIVITY PACKETS for GRINDING MACHINES
INSTRUCTIONAL UNIT UNIT I--GRINDING MACHINES	
LEARNING ACTIVITY PACKET NO. 1	PREREQUISITE LAP(S) None
PURPOSE: This Learning Activity Packet (LAP) outlines the study activities and performance tasks for "Grinding Machines." Accomplishing these procedures will aid the student in attaining a working knowledge of this area of training and in achieving a Skilled or Moderately Skilled competency level in the performance of jobs associated with this specialty.	
INTRODUCTION: The course of study in this LAP will help the student become able to identify types of grinding machines, to name the basic parts of the surface and cylindrical grinder, and to state the safety rules for operating grinding machines.	
TASKS INCLUDED IN THIS LAP: 1. Operate surface grinder controls properly. 2. Operate cylindrical grinder controls properly for manual feeds. 3. Operate cylindrical grinder controls properly for power feeds. 4. Balance a grinding wheel. 5. Mount a chuck to headstock.	

T10312



OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION

FRANCIS TUTTLE, DIRECTOR • 1515 WEST SIXTH AVE., • STILLWATER, OKLAHOMA 74074 • A.C. (405) 377-2000

User of LAP:

Included in this LAP are the answers to the pre-test and answers to the assignment sheets. If you desire to evaluate these two components, then it will be your responsibility to remove these components from the LAP prior to giving to the student. If you desire for the student to assume the responsibility for self-evaluation, then we would suggest that you leave the components contained as part of the LAP.

We hope this developmental design proves to be beneficial to you.

Sincerely,

Bob Patton, Coordinator
Curriculum and Instructional
Materials Center

BP:jd



EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER

GRINDING MACHINES
UNIT I--GRINDING MACHINES

LEARNING STEPS

Check the following
blanks as you complete
the required steps.

- | | |
|-------------------|--|
| _____ 1. Read | Unit and Specific Objectives, pages GM-1 through 2. |
| _____ 2. Complete | Grinding Machines Pretest, LAP page 11. |
| _____ 3. Study | The sections of the Information Sheet, pages GM-5 through GM-25, indicated by your instructor on your pretest. |
| _____ 4. Refer | To Step 17 of the pretest. If additional study is indicated for any of the Information Sheet, Sections I through IV or VI through XIV, continue to Learning Step 5. Otherwise, proceed to Learning Step 7. |
| _____ 5. Do | LAP Assignment Sheet #1, LAP page 33. |
| _____ 6. Do | LAP Assignment Sheet #2, LAP page 49. |
| _____ 7. Refer | To Step 17 of the pretest. If additional study is indicated for the Information Sheet, Section V, continue to Learning Step 8. Otherwise, proceed to Learning Step 11. |
| _____ 8. Do | Assignment Sheet #3--Interpret Grinding Wheel Markings, pages GM-53 through 54. |
| _____ 9. Stop. | Have your instructor evaluate Assignment Sheet #3. If your instructor is satisfied with your performance, proceed to Learning Step 11. Otherwise, continue to Learning Step 10. |

LEARNING STEPS

- ____ 10. Do LAP Assignment Sheet #3, LAP page 69.
- ____ 11. Refer To Step 17 of the pretest. If additional study is indicated for the Information Sheet, Section XV, continue to Learning Step 12. Otherwise, proceed to Learning Step 15.
- ____ 12. Do Assignment Sheet #1--Identify Causes of Grinding Problems, pages GM-45 through 48.
- ____ 13. Stop. Have your instructor evaluate Assignment Sheet #1. If your instructor is satisfied with your performance, proceed to Learning Step 15. Otherwise, continue to Learning Step 14.
- ____ 14. Do LAP Assignment Sheet #4, LAP page 73.
- ____ 15. Refer To Step 17 of the pretest. If additional study is indicated for the Information Sheet, Section XVI, continue to Learning Step 16. Otherwise, proceed to Learning Step 19.
- ____ 16. Do Assignment Sheet #2--State Rules for Safe Use of Grinding Machines, pages GM-49 through GM-51.
- ____ 17. Stop. Have your instructor evaluate Assignment Sheet #2. If your instructor is satisfied with your performance, proceed to Learning Step 19. Otherwise, continue to Learning Step 18.
- ____ 18. Do LAP Assignment Sheet #5, LAP page 79.

LEARNING STEPS

- ____ 19. Check The tasks below that you think you can perform without supervision.

Student Check		Instructor Initials/Date	
		Skilled	Moderately Skilled
____ a.	Operate surface grinder controls properly (22)	_____	_____
____ b.	Operate cylindrical grinder controls properly for manual feeds (28)	_____	_____
____ c.	Operate cylindrical grinder controls properly for power feeds (34)	_____	_____
____ d.	Balance a grinding wheel (40)	_____	_____
____ e.	Mount a chuck to headstock (46)	_____	_____

- ____ 20. Discuss Your competency in each task with your instructor. Your instructor will initial each task in which you demonstrate sufficient competency. If all tasks have been initialed by your instructor, proceed to Learning Step 51. Otherwise, continue to Learning Step 21.

- ____ 21. Refer To Learning Step 19a. If this task has been initialed by your instructor, proceed to Learning Step 27. Otherwise, continue to Learning Step 22.

- ____ 22. Study Job Sheet #1--Operate Surface Grinder Controls Properly, pages GM-59 through 62.

- ____ 23. Watch Slide/tape presentation, "Operate Surface Grinder Controls Properly" (GM-I-1.)

- ____ 24. Do Job Sheet #1--Operate Surface Grinder Controls Properly.

LEARNING STEPS

- ____ 25. Stop. Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 19a and proceed to Learning Step 27. Otherwise, repeat Learning Steps 22 through 24 and then continue to Learning Step 26.
- ____ 26. Stop. Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 19a and continue to Learning Step 27. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 19a and then continue to Learning Step 28.
- ____ 27. Refer To Learning Step 19b. If this task has been initialed by your instructor, proceed to Learning Step 33. Otherwise, continue to Learning Step 28.
- ____ 28. Study Job Sheet #2--Operate Cylindrical Grinder Controls Properly for Manual Feeds, pages GM-63 through 64.
- ____ 29. Watch Slide/tape presentation, "Operate Cylindrical Grinder Controls Properly for Manual Feeds" (GM-I-2).
- ____ 30. Do Job Sheet #2--Operate Cylindrical Grinder Controls Properly for Manual Feeds.
- ____ 31. Stop. Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 19b and proceed to Learning Step 33. Otherwise, repeat Learning Steps 28 through 30 and then continue to Learning Step 32.

LEARNING STEPS

- ____ 32. Stop. Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 19b and continue to Learning Step 33. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 19b and continue to Learning Step 33.
- ____ 33. Refer To Learning Step 19c. If this task has been initialed by your instructor, proceed to Learning Step 39. Otherwise, continue to Learning Step 34.
- ____ 34. Study Job Sheet #3--Operate Cylindrical Grinder Controls Properly for Power Feeds, pages GM-65 through 68.
- ____ 35. Watch Slide/tape presentation, "Operate Cylindrical Grinder Controls Properly for Power Feeds" (GM-I-2).
- ____ 36. Do Job Sheet #3--Operate Cylindrical Grinder Controls Properly for Power Feeds.
- ____ 37. Stop. Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 19b and then proceed to Learning Step 39. Otherwise, repeat Learning Steps 34 through 36 and continue to Learning Step 38.
- ____ 38. Stop. Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 19b and then continue to Learning Step 39. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 19b and continue to Learning Step 39.

LEARNING STEPS

- ____ 39. Refer To Learning Step 19d. If this task has been initialed by your instructor, proceed to Learning Step 45. Otherwise, continue to Learning Step 40.
- ____ 40. Study Job Sheet #4--Balance a Grinding Wheel, pages GM-69 through GM-71.
- ____ 41. Watch Slide/tape presentation, "Balance a Grinding Wheel" (GM-I-4).
- ____ 42. Do Job Sheet #4--Balance a Grinding Wheel.
- ____ 43. Stop. Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 19d and proceed to Learning Step 45. Otherwise, repeat Learning Steps 40 through 42 and continue to Learning Step 44.
- ____ 44. Stop. Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 19d and then continue to Learning Step 45. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 19d and continue to Learning Step 45.
- ____ 45. Refer To Learning Step 19e. If this task has been initialed by your instructor, proceed to Learning Step 51. Otherwise, continue to Learning Step 46.
- ____ 46. Study Job Sheet #5--Mount a Chuck to Headstock, page GM-73.
- ____ 47. Watch Slide/tape presentation, "Mount a Chuck to Headstock" (GM-I-5).

LEARNING STEPS

- ____ 48. Do Job Sheet #5--Mount a Chuck to Headstock.
- ____ 49. Stop. Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 19e and proceed to Learning Step 51. Otherwise, repeat Learning Steps 46 through 48 and continue to Learning Step 50.
- ____ 50. Stop. Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 19e and then continue to Learning Step 51. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 19e and continue to Learning Step 51.
- ____ 51. Review Information Sheet (pages GH-5 through GH-25) and LAP Assignment Sheets.
- ____ 52. Take Grinding Machines Test (see your instructor). If your score is 85 percent or above, continue to the next assigned Learning Activity Packet. Otherwise, ask your instructor about additional study requirements and possible retesting.

GRINDING MACHINES
UNIT I--GRINDING MACHINES

PRETEST

NAME _____ SCORE _____

DIRECTIONS: The purpose of this pretest is to determine how much you already know about grinding machines. Your performance on this pretest will not be used to determine your grade in the course. Instead, it will guide your instructor in designing this course to meet your needs. If you are unsure of the answer to a question, do not guess. Guessing might keep you from receiving needed instruction.

1. Match terms associated with grinding machines to their correct definitions. Write the correct numbers in the blanks. Terms and definitions continue on the next page.

- | | | |
|----------|---|-----------------------------|
| _____ a. | Solution used to carry or suspend abrasive particles during lapping operations; plural, <u>media</u> | 1. Operating or wheel speed |
| _____ b. | Rate at which workpiece or table traverse is moving; measured in feet per minute | 2. Wheel traverse speed |
| _____ c. | Rate of movement of grinding wheel across workpiece | 3. Profilometer |
| _____ d. | Black layer on surface of steel that has been heat-treated or formed hot; must be removed before grinding | 4. Medium |
| _____ e. | Instrument for measuring the degree of surface roughness in microinches (0.000001 inch) | 5. Loaded |
| _____ f. | Speed of revolving grinding wheel expressed in revolutions per minute (rpm) or surface feet per minute (sfm) | 6. Honing |
| _____ g. | Condition of grinding wheel in which the pores are filled with material being ground; results in poor finish on workpiece and reduced cutting action of wheel | 7. Work speed |
| _____ h. | Operation using bonded abrasive stick in special holder to remove stock and produce a desired surface accuracy | 8. Scale |

PRETEST

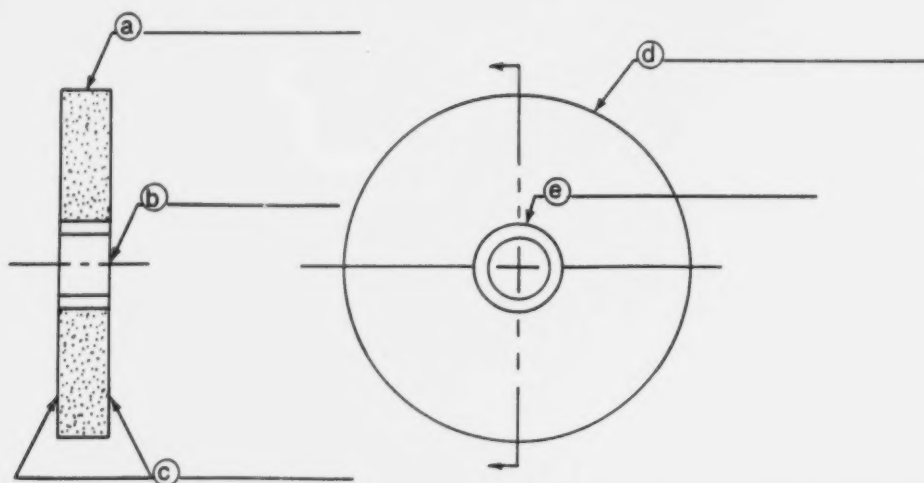
- | | | |
|--------|---|-------------------|
| ___ i. | Dulling of cutting particles of grinding wheel; results in decreased cutting efficiency | 9. Generated heat |
| ___ j. | Increased temperature of workpiece and wheel caused by friction of grinding | 10. Glazing |
| ___ k. | Process to improve or alter cutting action of grinding wheel | 11. Burr |
| ___ l. | Turned-over edge of metal caused by grinding operation | 12. Balancing |
| ___ m. | Part of grinding wheel dresser that comes into contact with wheel and does the dressing or shaping | 13. Dressing |
| ___ n. | Adding, subtracting, or positioning weights on grinding wheel hub so that wheel weight will be evenly distributed | 14. Cutter |
2. Match grinding machine operations to their correct descriptions. Write the correct numbers in the blanks.
- | | | |
|--------|---|--------------------|
| ___ a. | Process of grinding the gates, fins, and spurs from castings | 1. Rough grinding |
| ___ b. | Final grinding operation to improve dimensional accuracy and obtain desired or near desired finish | 2. Finish grinding |
| ___ c. | Finishing process that uses loose abrasive grains carried by a medium to produce a desired surface finish | 3. Lapping |
| ___ d. | First grinding operation to reduce stock rapidly without particular regard to finish produced | 4. Snagging |

PRETEST

3. Identify the parts of the grinding wheel illustrated below. Write the correct names in the blanks.

Face
Bushing
Wall

Periphery
Arbor hole



4. Match grinding wheel types to their common applications. Write the correct numbers in the blanks. Applications continue on the next page.

- | | | |
|----------|---|----------|
| _____ a. | Flaring-cup wheel designed for side grinding and used primarily for tool and cutter grinding | Type #12 |
| | | Type #1 |
| _____ b. | Straight wheel recessed on both sides; used primarily for surface and cylindrical grinding machine operations | Type #6 |
| | | Type #11 |
| _____ c. | Dish wheel designed for side grinding with periphery grinding possible; used primarily for toolroom grinding because its thinness permits grinding in narrow places | Type #5 |
| | | Type #7 |
| _____ d. | Straight-cup wheel designed for side grinding and used primarily for cutter grinding; large sizes of this type are used on vertical spindle grinders | |
| _____ e. | Straight wheel used for surface, internal, cylindrical, and off-hand grinding machine operations | |

PRETEST

- _____ f. Straight grinding wheel recessed on one side so that greater wheel thickness can be used; used primarily for surface, cylindrical, and off-hand grinding machine operations
5. Match grinding wheel compositions to their correct descriptions. Write the correct numbers in the blanks.
- | | |
|--|------------------|
| _____ a. Material in the grinding wheel that acts as the cutting agent; designated with numbers and letters, with the letters identifying the main base | 1. Bond |
| | 2. Abrasive |
| | 3. Grain or grit |
| _____ b. Material that holds abrasive together; designated by a letter or letters and/or numbers | 4. Structure |
| | 5. Grade |
| _____ c. Size of abrasive expressed as a number from 10 (coarse) to 600 (very fine) | |
| _____ d. Strength of the bond that holds wheel abrasives together; determines rate at which wheel will break down; designated by letters from A (soft) to Z (hard) | |
| _____ e. Grain spacing designated by a number from 1 to 12; the higher the number, the more "open" the structure | |
6. List four reasons for truing and balancing grinding wheels.

- a. _____

- b. _____

- c. _____

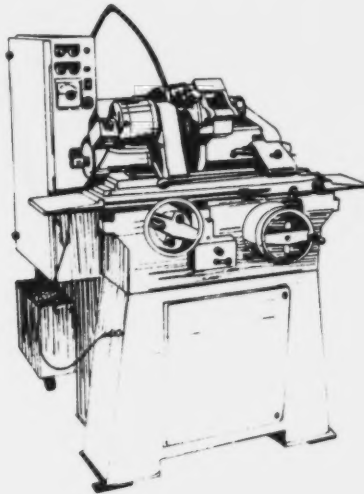
- d. _____

PRETEST

7. Identify the types of abrasive cutting machines illustrated below. Write the correct names in the blanks.

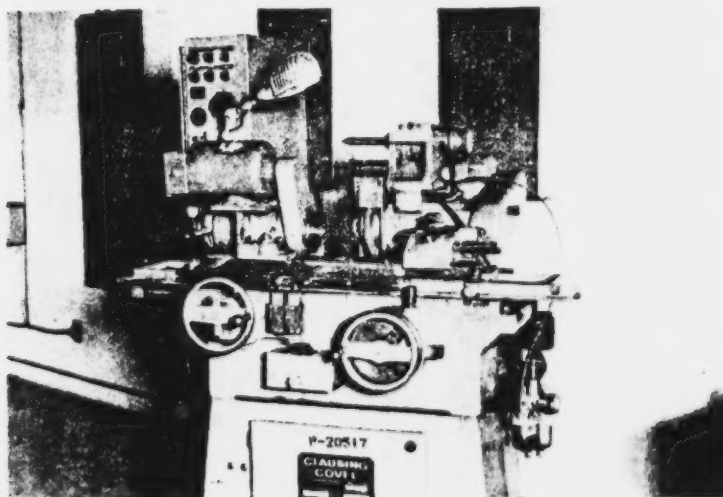
Universal grinder
Universal and tool grinder

Internal/external grinder
Surface grinder



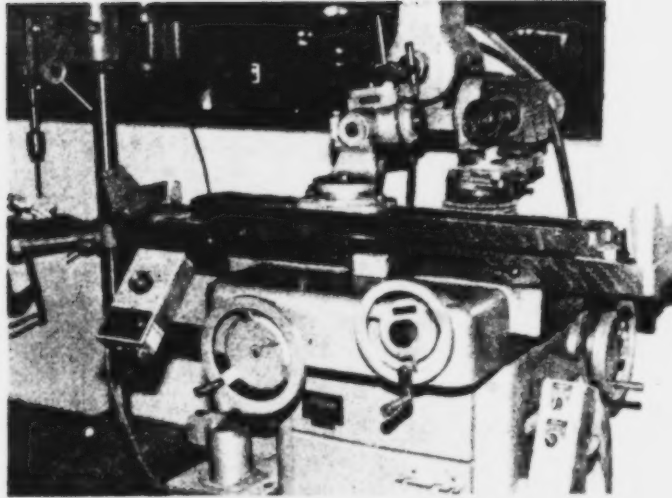
Used with permission of Covell Manufacturing Company, Division of Clausing Corporation, Kalamazoo, Michigan.

a. _____

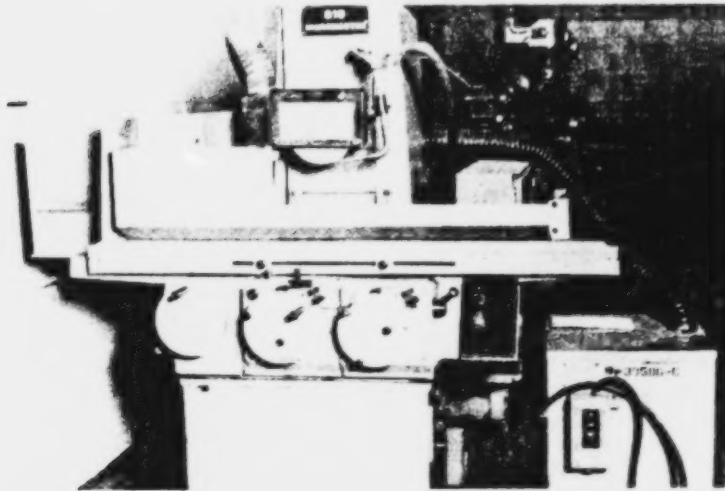


b. _____

PRETEST



c. _____



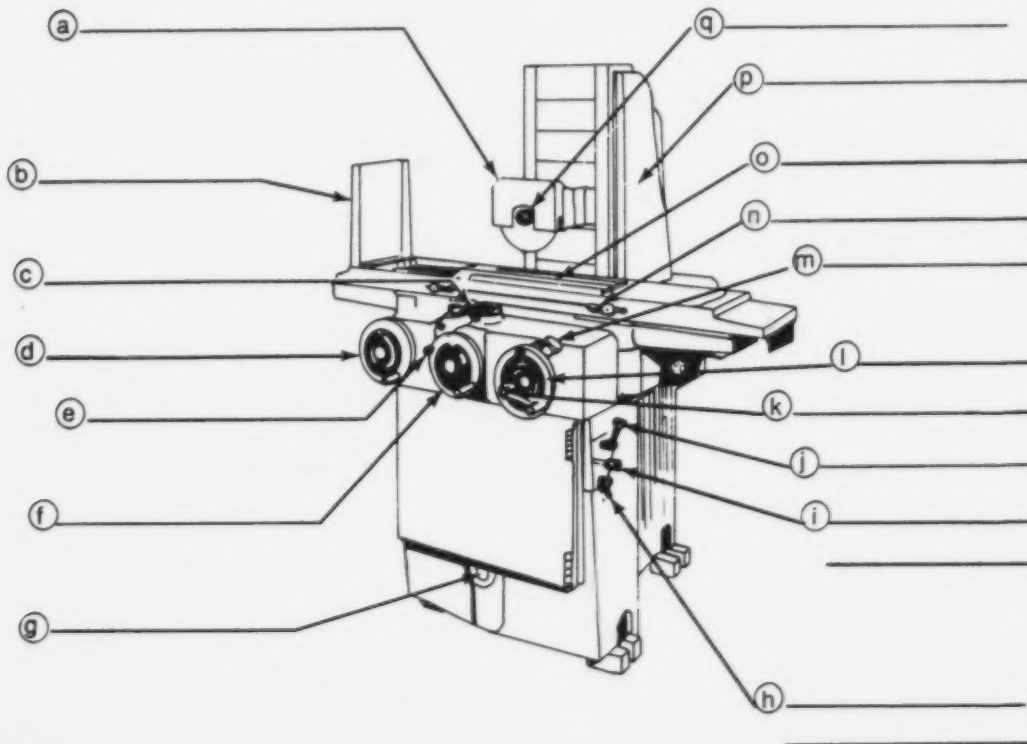
d. _____

PRETEST

8. Identify the parts of the surface grinder illustrated below. Write the correct names in the blanks.

Wheel guard
Dial locknut
Cross-feed regulating screw
Elevating handwheel
Table
Table handwheel
Wheel truing and rapid
positioning lever
Table dog

Dust deflector
Oil level sight glass
Cross-feed directional lever
Fine-feed adjustment knob
Table-reversing lever
Cross-feed handwheel
Upright
Fine-feed locknut
Spindle



Source: "Operation and Maintenance of the 618 Micromaster Surface Grinding Machines," Brown and Sharpe Manufacturing Company.

PRETEST

9. Match parts of a surface grinder to their correct functions. Write the correct numbers in the blanks. Functions continue on the next page.

- | | | |
|----------|--|---|
| _____ a. | Provides rapid movement of spindle up and down | 1. Table handwheel |
| _____ b. | Changes direction of table when moving right or left by power feed | 2. Table |
| _____ c. | Engages power-feed mechanism and allows upright to move in or out by power | 3. Fine-feed adjustment knob |
| _____ d. | Allows visual inspection of oil level | 4. Oil level sight glass |
| _____ e. | Houses motor, spindle, and elevating mechanism; moves in and out on ways by means of cross-feed regulating screw | 5. Table dogs |
| _____ f. | Regulates amount of step-over for each cut the wheel makes | 6. Dust deflector |
| _____ g. | Raises and lowers elevating mechanism of spindle; each graduation is 0.0002 inch | 7. Wheel truing and rapid positioning lever |
| _____ h. | Aligns grinding wheel mounting hub and secures hub so that it will run true | 8. Fine-feed locknut |
| _____ i. | Moves upright toward and away from table | 9. Cross-feed directional lever |
| _____ j. | Provides a flat surface to which workpiece or work-holding devices are mounted | 10. Upright |
| _____ k. | Allows outer graduated ring of cross-feed or elevating wheel to be moved or set without moving feed mechanism | 11. Cross-feed handwheel |
| _____ l. | Regulate length of table travel by tripping table-reversing lever | 12. Table-reversing lever |
| _____ m. | Moves upright in and out, overrides the feed setting, and moves at a set rapid rate | 13. Dial locknut |
| | | 14. Spindle |
| | | 15. Elevating handwheel |
| | | 16. Wheel guard |
| | | 17. Cross-feed regulating screw |

PRETEST

- ____ n. When tightened, engages fine-feed adjustment knob; when loose, allows rapid movement by handwheels
- ____ o. Helps control grinding dust and serves as protective guard in the event that grinding wheel explodes
- ____ p. Moves table right or left
- ____ q. Shields user from dust and chipped particles from wheel or workpiece

10. Identify major parts of the cylindrical grinder illustrated below. Write the correct names in the blanks.

Cross-feed handwheel

Table handwheel

Table dog, left

Swivel table

Machine start/stop push buttons

External spindle

Table dog, right

Headstock

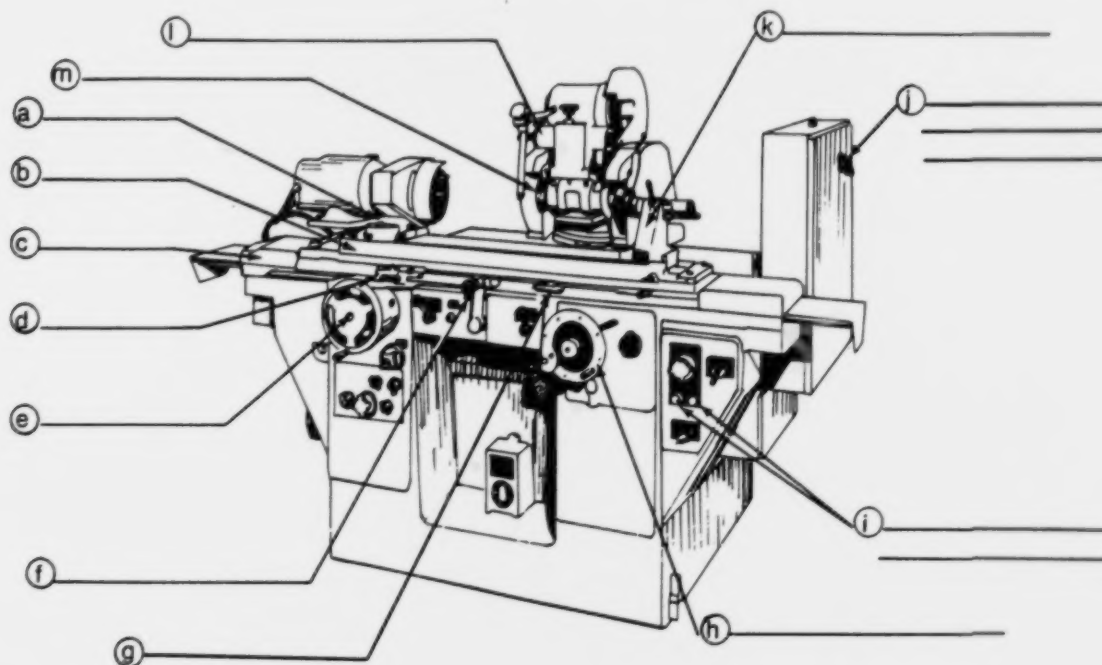
Sliding table

Table-reversing lever

Internal spindle

Footstock

Electrical control compartment



Used with permission of Brown and Sharpe Manufacturing Company.

PRETEST

11. Match major parts of a cylindrical grinder to their correct functions. Write the correct numbers in the blanks.

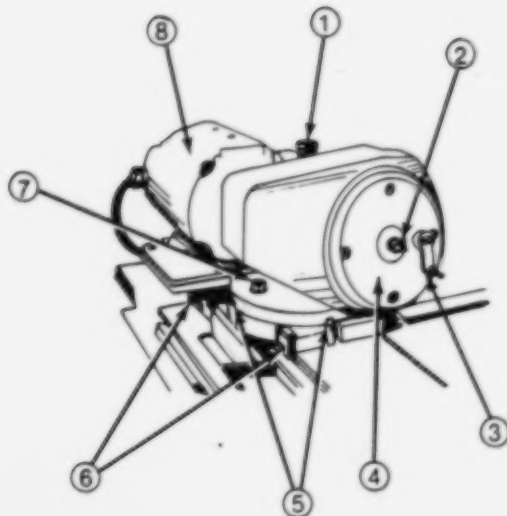
- | | | |
|----------|--|-------------------------------------|
| _____ a. | Houses main power controls for all electrical components | 1. Footstock |
| _____ b. | Start external spindle and provide power to other controls | 2. Internal spindle |
| _____ c. | Top part of sliding table; has T-slot for mounting work-holding devices or wheel dresser; adjustable to allow grinding of tapers | 3. Cross-feed handwheel |
| _____ d. | Regulate direction of table movement by striking table-reversing lever as table moves by power feed | 4. Electrical control compartment |
| _____ e. | Holds wheel and wheel hub for external grinding | 5. Table handwheel |
| _____ f. | Holds internal quill and wheels for grinding | 6. Sliding table |
| _____ g. | Moves upright in (toward table) or out (away from table) by manual feed | 7. Table-reversing lever |
| _____ h. | Moves sliding table right and left by manual feed | 8. Swivel table |
| _____ i. | Reverses direction of sliding table when table is under power feed | 9. Headstock |
| _____ j. | Supports workpiece and revolves workpiece at set surface feet per minute rate | 10. Machine start/stop push buttons |
| _____ k. | Main part of table; moves right and left by power or manual feed; carries swivel table | 11. Table dogs |
| _____ l. | Holds workpiece when set up between centers | 12. External spindle |

PRETEST

12. Identify selected controls and components of a cylindrical grinder. Write the correct numbers in the blanks.

HEADSTOCK

- | | |
|----------------------------------|-----------------------------------|
| ___ a. Center | ___ e. Headstock base clamp bolts |
| ___ b. Index finger | ___ f. Work-driving plate |
| ___ c. Work-driving arm | ___ g. Headstock motor |
| ___ d. Swivel clamp bolt (front) | ___ h. Spindle-locking plunger |

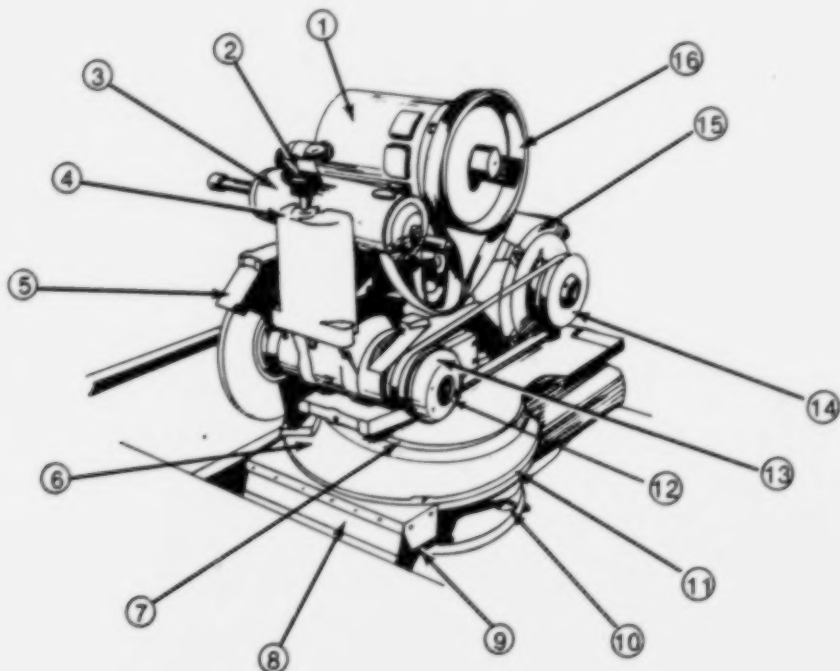


Used with permission of Brown and Sharpe Manufacturing Company.

PRETEST

UPRIGHT

- | | |
|--|--|
| ___ a. Wheel spindle head | ___ i. Wheel slide |
| ___ b. External grinding spindle | ___ j. Turret locking-pin knob |
| ___ c. Internal grinding spindle motor | ___ k. External grinding spindle motor |
| ___ d. Wheel slide water guard | ___ l. Wheel guard, left |
| ___ e. Internal spindle bracket | ___ m. Wheel slide base |
| ___ f. Motor sheave | ___ n. Internal grinding spindle unit |
| ___ g. Universal turret | ___ o. Wheel sleeve, right |
| ___ h. Motor pulley | ___ p. Locking-screw knob |

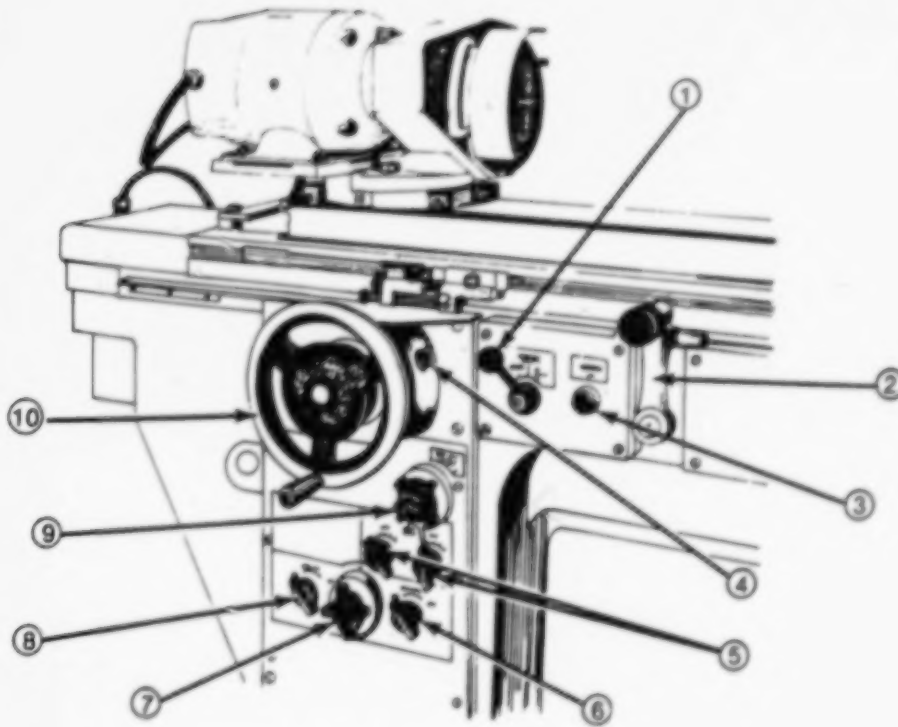


Used with permission of Brown and Sharpe Manufacturing Company.

PRETEST

CONTROLS ON LEFT FRONT OF MACHINE

- | | |
|--|---|
| ___ a. Table dwell switches | ___ f. Table speed selector knob |
| ___ b. Headstock jog button | ___ g. Amount of cross-feed knob |
| ___ c. Headstock and table control lever | ___ h. Handwheel shaft-locking plunger knob |
| ___ d. Table handwheel | ___ i. Feed, left on/off |
| ___ e. Table-reversing lever | ___ j. Feed, right on/off |

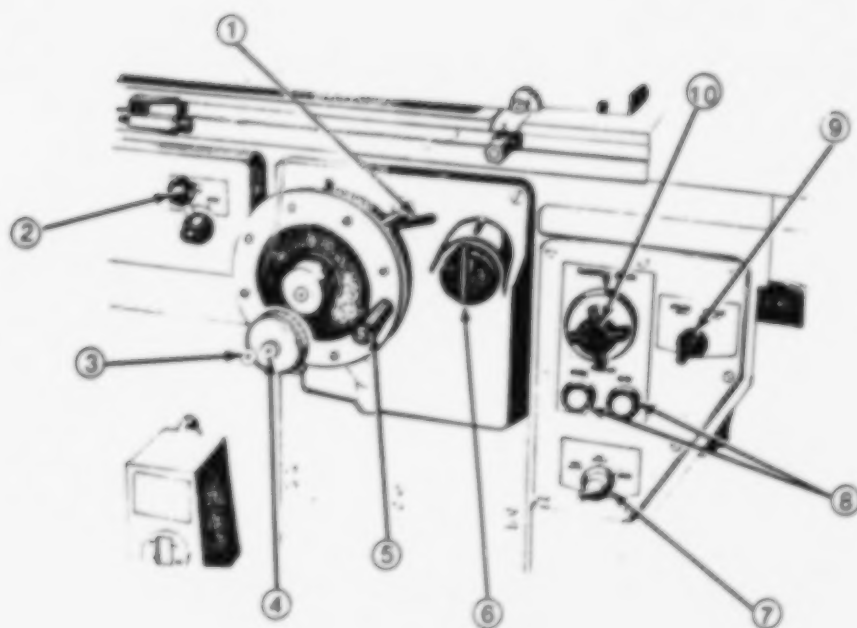


Used with permission of Brown and Sharpe Manufacturing Company.

PRETEST

CONTROLS ON RIGHT FRONT OF MACHINE

- | | |
|---|---|
| ___ a. Cross-feed control lever | ___ f. Disengagement knob |
| ___ b. Index plunger | ___ g. Cross-feed handwheel |
| ___ c. Cross-feed gear-shifting knob | ___ h. Headstock speed control knob |
| ___ d. Switch operating slide throw-out lever | ___ i. Machine start/stop push buttons |
| ___ e. Lever/handwheel selector switch | ___ j. Internal/external grinding selector knob |

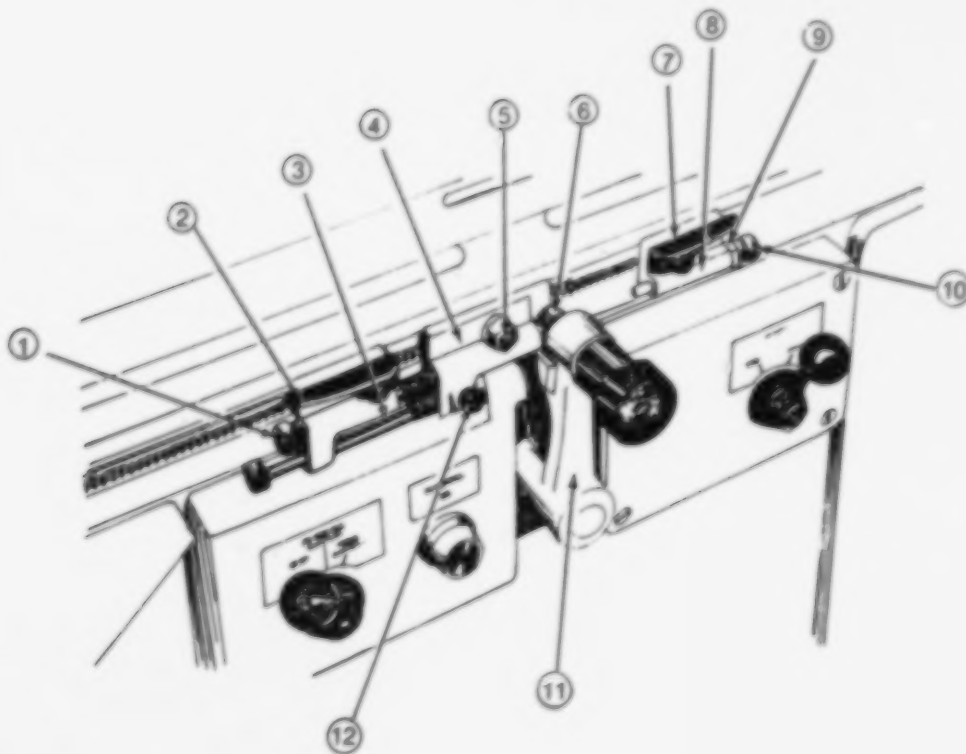


Used with permission of Brown and Sharpe Manufacturing Company.

PRETEST

CONTROLS ON CENTER FRONT OF MACHINE

- | | |
|------------------------------------|------------------------------------|
| ___ a. Table dog, right | ___ g. Table-reversing lever |
| ___ b. Adjusting screw knob, right | ___ h. Table dog pawl lever, right |
| ___ c. Table stop adjustment screw | ___ i. Adjusting screw knob, left |
| ___ d. Table dog, left | ___ j. Reversing lever plunger |
| ___ e. Table dog pawl lever, left | ___ k. Table stop clamp screw |
| ___ f. Table dog clamp bolt | ___ l. Check nut |

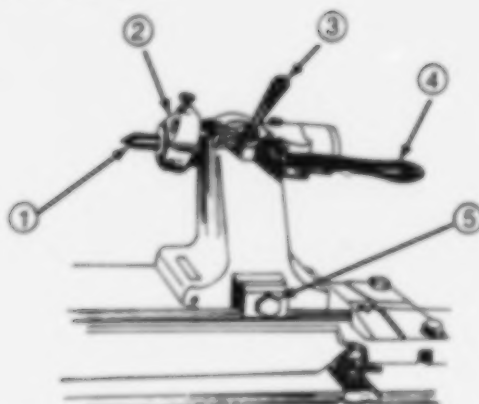


Used with permission of Brown and Sharpe Manufacturing Company.

PRETEST

PARTS OF THE FOOTSTOCK

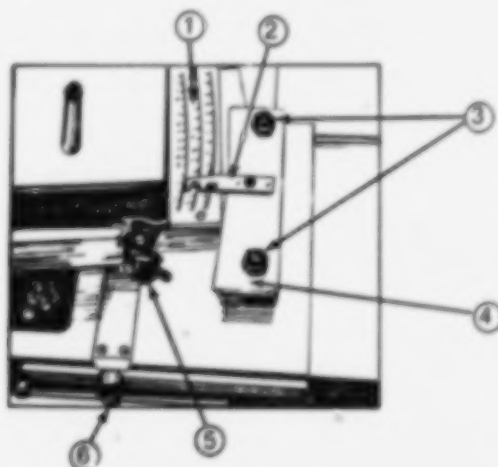
- | | |
|-----------------------------|---------------------------------|
| ___ a. Center | ___ d. Operating lever |
| ___ b. Spindle clamp handle | ___ e. Footstock clamp and bolt |
| ___ c. Footstock dust guard | |



Used with permission of Brown and Sharpe Manufacturing Company.

PARTS OF THE SWIVEL TABLE ADJUSTMENT

- | | |
|-------------------------|---------------------------|
| ___ a. Adjusting nut | ___ d. Swivel table scale |
| ___ b. Locking-pin knob | ___ e. Table clamp bolts |
| ___ c. Table clamp | ___ f. Index finger |



Used with permission of Brown and Sharpe Manufacturing Company.

PRETEST

13. Match methods of applying coolants to their correct descriptions. Write the correct numbers in the blanks.

- | | | |
|----------|---|----------------------|
| _____ a. | Small nozzle mixes coolant with air; mixture is blown onto wheel and workpiece; helps clean wheel and cool workpiece, and provides for an unobstructed view of wheel and workpiece | 1. Flood |
| _____ b. | Coolant is stored in wheel flanges; holes drilled into wheel allow the wheel to absorb coolant to ensure that coolant gets to wheel/workpiece interface | 2. Mist or spray |
| _____ c. | Coolant is forced through piping to a nozzle that directs coolant onto wheel at point of contact, thus washing wheel and cooling workpiece; coolant drains back into system and is filtered before being recycled | 3. Through-the-wheel |

14. Match grinding operation problems to their correct descriptions. Write the correct numbers in the blanks.

- | | | |
|----------|---|-----------------|
| _____ a. | Irregular marks left in surface of workpiece | 1. Explosion |
| _____ b. | Pattern produced on workpiece as a result of table or workpiece movement | 2. Feed lines |
| _____ c. | Excessive vibration of grinding wheel | 3. Hollow spots |
| _____ d. | Areas on workpiece that have been allowed to heat excessively, causing them to expand and be ground off | 4. Scratches |
| _____ e. | Breaking up of a grinding wheel as a result of turning faster than its maximum safe operating speed or from being improperly stored | 5. Burning |
| _____ f. | Unwanted pattern on workpiece resulting from slowing or stopping of grinding wheel due to excess pressure or friction | 6. Chatter |
| _____ g. | Change in workpiece being ground caused by grinding heat; usually results in discoloration of surface | 7. Check marks |

PRETEST

15. List possible causes of grinding operation problems.

CHATTER (List six causes.)

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____

BURNT OR DISCOLORED FINISH (List six causes.)

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____

FEED LINES (List five causes.)

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

SCRATCHES (List six causes.)

- a. _____
- b. _____
- c. _____

PRETEST

- d. _____
- e. _____
- f. _____

SHORT AND LONG WAVE MARKS (List five causes.)

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

SPIRALS (List five causes.)

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

CHECK MARKS (List five causes.)

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

16. State rules for grinding machine safety. Describe how each of the following words or phrases applies to grinding machine safety.

- a. Eyes-- _____

PRETEST

- b. Guards-- _____

- c. Hands-- _____

- d. Ring test-- _____

- e. Handling-- _____

- f. Storing-- _____

- g. Force-- _____

- h. Operating speed-- _____

- i. Mounting flanges-- _____

PRETEST

- j. Mounting blotters-- _____

- k. Mounting nut-- _____

- l. Starting-- _____

- m. Grinding-- _____

- n. Wheel selection-- _____

- o. Wet grinding-- _____

- p. Work-- _____

- q. Trip dogs-- _____

PRETEST

- r. Dressing-- _____

- s. Centers-- _____

17. Stop. Have your instructor evaluate your test and mark the area(s) below requiring additional study.

Refer to Information Sheet, Section(s)

____ I	____ V	____ IX	____ XIII
____ II	____ VI	____ X	____ XIV
____ III	____ VII	____ XI	____ XV
____ IV	____ VIII	____ XII	____ XVI

You came here from Learning Step 2. If none of the above sections are checked, proceed to Learning Step 19. Otherwise, continue to Learning Step 3.

GRINDING MACHINES
UNIT I--GRINDING MACHINES

LAP ASSIGNMENT SHEET #1

NAME _____ SCORE _____

1. Match terms associated with grinding machines to their correct definitions. Write the correct numbers in the blanks. Definitions continue on the next page.

- | | | |
|----------|---|------------------------------|
| _____ a. | Black layer on surface of steel that has been heat-treated or formed hot; must be removed before grinding | 1. Glazing |
| _____ b. | Instrument for measuring the degree of surface roughness in microinches (0.000001 inch) | 2. Honing |
| _____ c. | Speed of revolving grinding wheel expressed in revolutions per minute (rpm) or surface feet per minute (sfm) | 3. Burr |
| _____ d. | Condition of grinding wheel in which the pores are filled with material being ground; results in poor finish on workpiece and reduced cutting action of wheel | 4. Loaded |
| _____ e. | Operation using bonded abrasive stick in special holder to remove stock and produce a desired surface accuracy | 5. Cutter |
| _____ f. | Dulling of cutting particles of grinding wheel; results in decreased cutting efficiency | 6. Scale |
| _____ g. | Solution used to carry or suspend abrasive particles during lapping operations; plural, <u>media</u> | 7. Profilometer |
| _____ h. | Rate at which workpiece or table traverse is moving; measured in feet per minute | 8. Generated heat |
| _____ i. | Rate of movement of grinding wheel across workpiece | 9. Medium |
| _____ j. | Part of grinding wheel dresser that comes into contact with wheel and does the dressing or shaping | 10. Balancing |
| | | 11. Operating or wheel speed |
| | | 12. Work speed |
| | | 13. Wheel traverse speed |
| | | 14. Dressing |

LAP ASSIGNMENT SHEET #1

- _____ k. Increased temperature of workpiece and wheel caused by friction of grinding
- _____ l. Process to improve or alter cutting action of grinding wheel
- _____ m. Turned-over edge of metal caused by grinding operation
- _____ n. Adding, subtracting, or positioning weights on grinding wheel hub so that wheel weight will be evenly distributed

2. Identify grinding machine operations. Write the correct names in the blanks. Some blanks will contain more than one word.

Snagging
Rough grinding

Finish grinding
Lapping

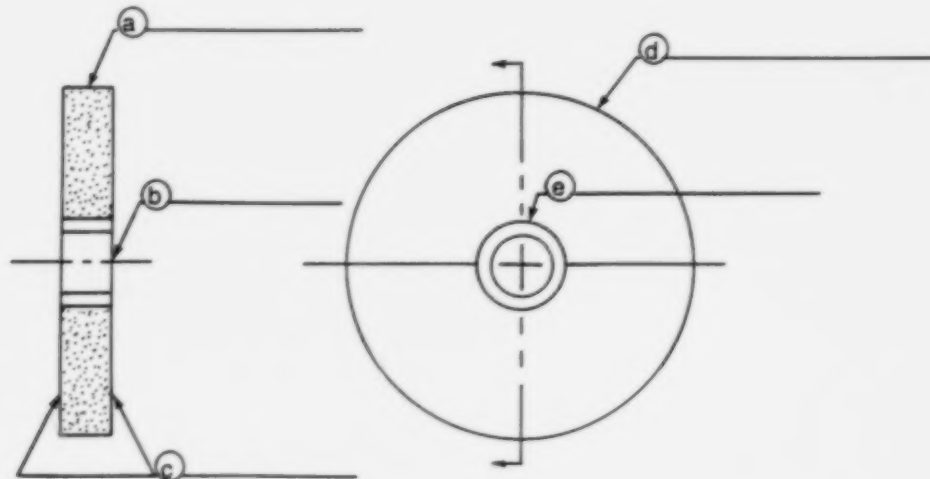
- a. _____ --Process of grinding the gates, fins, and spurs from castings
- b. _____ --Final grinding operation to improve dimensional accuracy and obtain desired or near desired finish
- c. _____ --Finishing process that uses loose abrasive grains carried by a medium to produce a desired surface finish
- d. _____ --First grinding operation to reduce stock rapidly without particular regard to finish produced

LAP ASSIGNMENT SHEET #1

3. Identify the parts of the grinding wheel illustrated below. Write the correct names in the blanks.

Face
Bushing
Wall

Periphery
Arbor hole



4. Match grinding wheel types to their common applications. Write the correct type number in each blank. Applications continue on the next page.

- | | | |
|----------|---|---------------------------------|
| _____ a. | Dish wheel designed for side grinding with periphery grinding possible; used primarily for toolroom grinding because its thinness permits grinding in narrow places | Type #1
Type #5
Type #6 |
| _____ b. | Straight-cup wheel designed for side grinding and used primarily for cutter grinding; large sizes of this type are used on vertical spindle grinders | Type #7
Type #11
Type #12 |
| _____ c. | Flaring-cup wheel designed for side grinding and used primarily for tool and cutter grinding | |
| _____ d. | Straight wheel recessed on both sides; used primarily for surface and cylindrical grinding machine operations | |

LAP ASSIGNMENT SHEET #1

- _____ e. Straight grinding wheel recessed on one side so that greater wheel thickness can be used; used primarily for surface, cylindrical, and off-hand grinding machine operations
- _____ f. Straight wheel used for surface, internal, cylindrical, and off-hand grinding machine operations

5. Select from the list below to complete the following statements concerning reasons for truing and balancing grinding wheels. Write the correct words in the blanks.

Vibration
Bearing
Spindle

Concentric
Chatter
Breakage

- a. To make the wheel _____ with spindle of grinding machine
- b. To eliminate _____ marks
- c. To eliminate _____
- d. To prevent wheel _____
- e. To prevent excessive _____ failure and damage to _____
6. List the types of abrasive cutting machines.

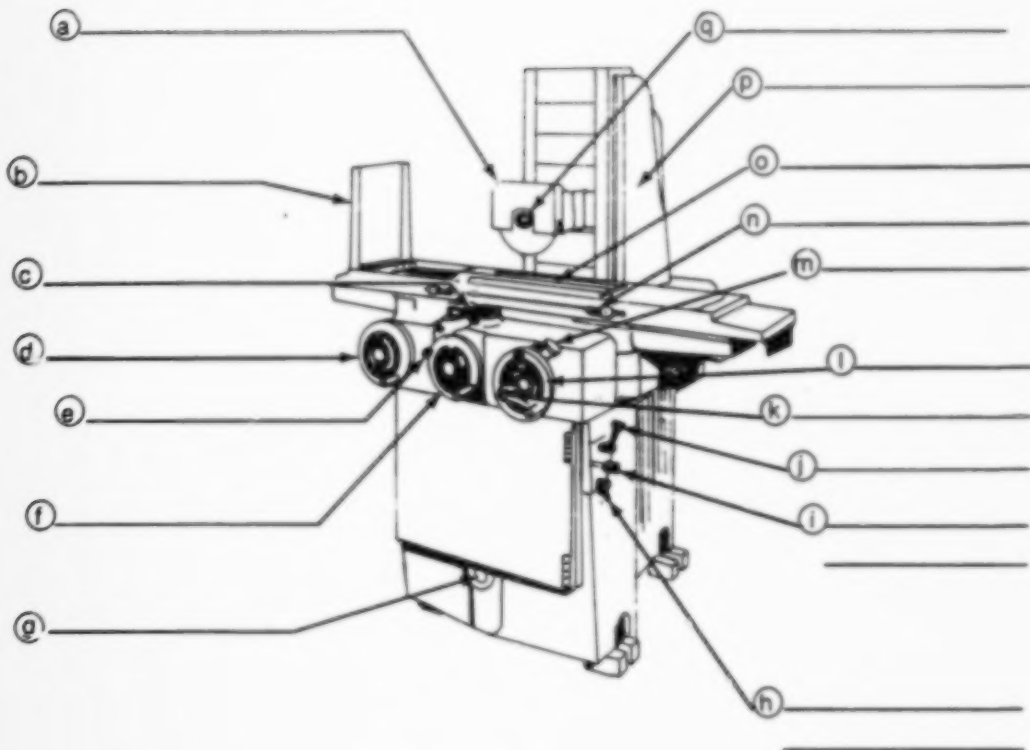
- a. _____
- b. _____
- c. _____
- d. _____

LAP ASSIGNMENT SHEET #1

7. Identify the parts of the surface grinder illustrated below. Write the correct names in the blanks.

Wheel guard
Dial locknut
Cross-feed regulating screw
Elevating handwheel
Table
Table handwheel
Wheel truing and rapid
positioning lever
Table dog

Dust deflector
Oil level sight glass
Cross-feed directional lever
Fine-feed adjustment knob
Table-reversing lever
Cross-feed handwheel
Upright
Fine-feed locknut
Spindle



Source: "Operation and Maintenance of the 618 Micrometer Surface Grinding Machines," Brown and Sharpe Manufacturing Company.

LAP ASSIGNMENT SHEET #1

8. Match parts of a surface grinder to their correct functions. Write the correct numbers in the blanks. Functions continue on the next page.

- | | | |
|----------|--|--|
| _____ a. | Provides a flat surface to which workpiece or work-holding devices are mounted | 1. Table |
| _____ b. | When tightened, engages fine-feed adjustment knob; when loose, allows rapid movement by handwheels | 2. Wheel guard |
| _____ c. | Allows visual inspection of oil level | 3. Spindle |
| _____ d. | Engages power-feed mechanism and allows upright to move in or out by power | 4. Dust deflector |
| _____ e. | Regulates amount of step-over for each cut the wheel makes | 5. Fine-feed adjustment knob |
| _____ f. | Regulate length of table travel by tripping table-reversing lever | 6. Table-reversing lever |
| _____ g. | Houses motor, spindle, and elevating mechanism; moves in and out on ways by means of cross-feed regulating screw | 7. Table handwheel |
| _____ h. | Allows outer graduated ring of cross-feed or elevating wheel to be moved or set without moving feed mechanism | 8. Elevating handwheel |
| _____ i. | Raises and lowers elevating mechanism of spindle; each graduation is 0.0002 inch | 9. Cross-feed regulating screw |
| _____ j. | Aligns grinding wheel mounting hub and secures hub so that it will run true | 10. Fine-feed locknut |
| _____ k. | Helps control grinding dust and serves as protective guard in the event that grinding wheel explodes | 11. Oil level sight glass |
| _____ l. | Moves upright in and out, overrides the feed setting, and moves at a set rapid rate | 12. Wheel truing and rapid positioning lever |
| _____ m. | Provides rapid movement of spindle up and down | 13. Table dogs |
| | | 14. Upright |
| | | 15. Cross-feed directional lever |
| | | 16. Dial locknut |
| | | 17. Cross-feed handwheel |

LAP ASSIGNMENT SHEET #1

- ____ n. Changes direction of table when moving right or left by power feed
 - ____ o. Moves upright toward and away from table
 - ____ p. Shields user from dust and chipped particles from wheel or workpiece
 - ____ q. Moves table right or left
9. Identify the major parts of the cylindrical grinder illustrated below. Write the correct names in the blanks.

Cross-feed handwheel

Table handwheel

Table dog, left

Swivel table

Machine start/stop push buttons

External spindle

Table dog, right

Headstock

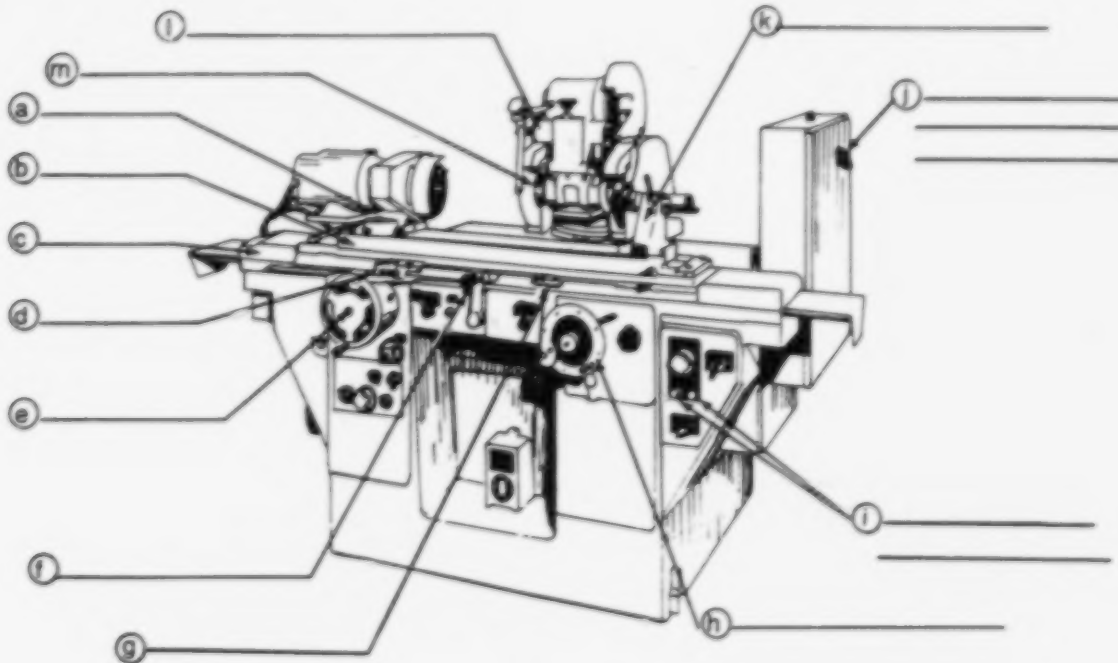
Sliding table

Table-reversing lever

Internal spindle

Footstock

Electrical control compartment



Used with permission of Brown and Sharpe Manufacturing Company.

LAP ASSIGNMENT SHEET #1

10. Match major parts of a cylindrical grinder to their correct functions. Write the correct numbers in the blanks.

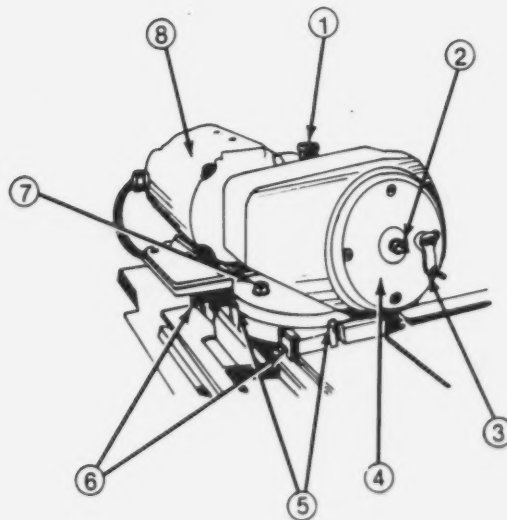
- | | | |
|----------|--|------------------------------------|
| _____ a. | Moves sliding table right and left by manual feed | 1. Table handwheel |
| _____ b. | Supports workpiece and revolves workpiece at set surface feet per minute rate | 2. Swivel table |
| _____ c. | Holds internal quill and wheels for grinding | 3. Sliding table |
| _____ d. | Holds wheel and wheel hub for external grinding | 4. Table-reversing lever |
| _____ e. | Main part of table; moves right and left by power or manual feed; carries swivel table | 5. Internal spindle |
| _____ f. | Reverses direction of sliding table when table is under power feed | 6. Headstock |
| _____ g. | Regulate direction of table movement by striking table-reversing lever as table moves by power feed | 7. Cross-feed handwheel |
| _____ h. | Start external spindle and provide power to other controls | 8. Electrical control compartment |
| _____ i. | Top part of sliding table; has T-slot for mounting work-holding devices or wheel dresser; adjustable to allow grinding of tapers | 9. Machine start/stop push buttons |
| _____ j. | Houses main power controls for all electrical components | 10. Table dogs |
| _____ k. | Moves upright in (toward table) or out (away from table) by manual feed | 11. Footstock |
| _____ l. | Holds workpiece when set up between centers | 12. External spindle |

LAP ASSIGNMENT SHEET #1

11. Identify selected controls and components of a cylindrical grinder. Write the correct numbers in the blanks.

HEADSTOCK

- | | |
|------------------------------------|-------------------------------------|
| _____ a. Index finger | _____ e. Work-driving arm |
| _____ b. Headstock motor | _____ f. Center |
| _____ c. Swivel clamp bolt (front) | _____ g. Spindle-locking plunger |
| _____ d. Work-driving plate | _____ h. Headstock base clamp bolts |

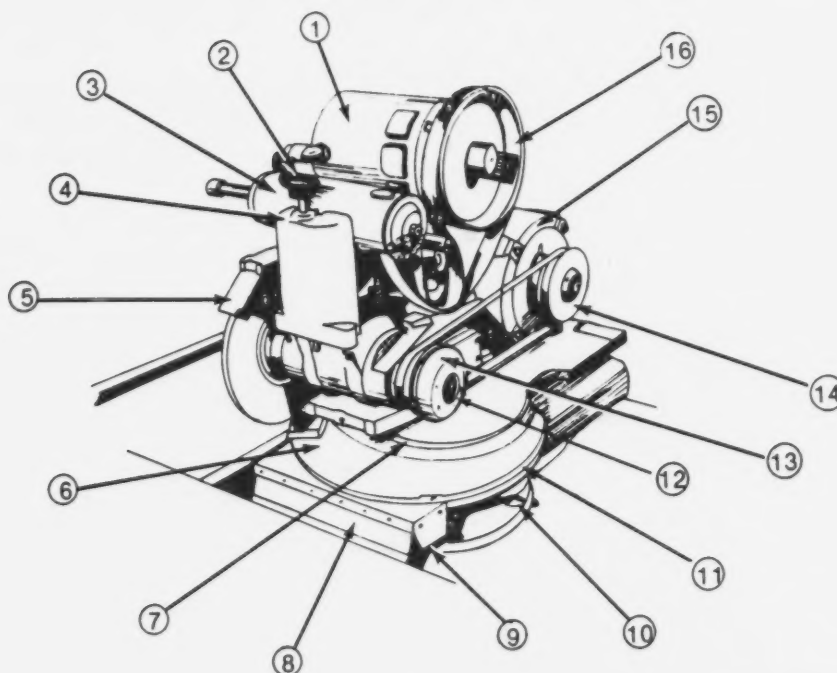


Used with permission of Brown and Sharpe Manufacturing Company.

LAP ASSIGNMENT SHEET #1

UPRIGHT

- | | |
|--|--|
| ___ a. Motor pulley | ___ i. Wheel sleeve, right |
| ___ b. Locking-screw knob | ___ j. Universal turret |
| ___ c. Wheel spindle head | ___ k. Wheel slide |
| ___ d. Turret locking-pin knob | ___ l. Wheel guard, left |
| ___ e. Wheel slide base | ___ m. Motor sheave |
| ___ f. Internal spindle bracket | ___ n. External grinding spindle |
| ___ g. Internal grinding spindle unit | ___ o. External grinding spindle motor |
| ___ h. Internal grinding spindle motor | ___ p. Wheel slide water guard |

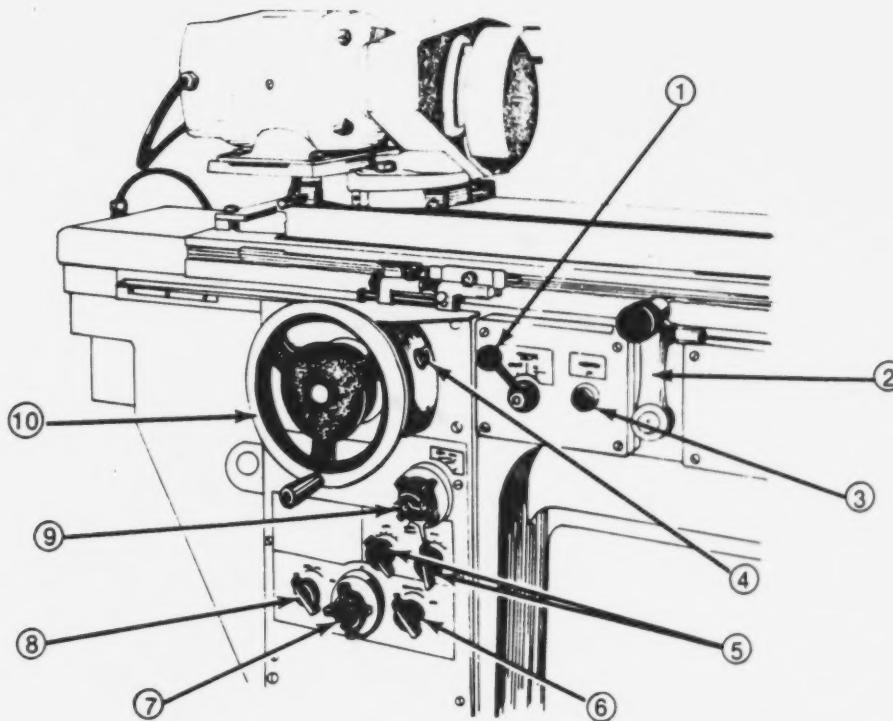


Used with permission of Brown and Sharpe Manufacturing Company.

LAP ASSIGNMENT SHEET #1

CONTROLS ON LEFT FRONT OF MACHINE

- | | |
|--|---|
| ___ a. Headstock and table control lever | ___ f. Handwheel shaft-locking plunger knob |
| ___ b. Feed, right on/off | ___ g. Table-reversing lever |
| ___ c. Table dwell switches | ___ h. Table speed selector knob |
| ___ d. Feed, left on/off | ___ i. Headstock jog button |
| ___ e. Table handwheel | ___ j. Amount of cross-feed knob |

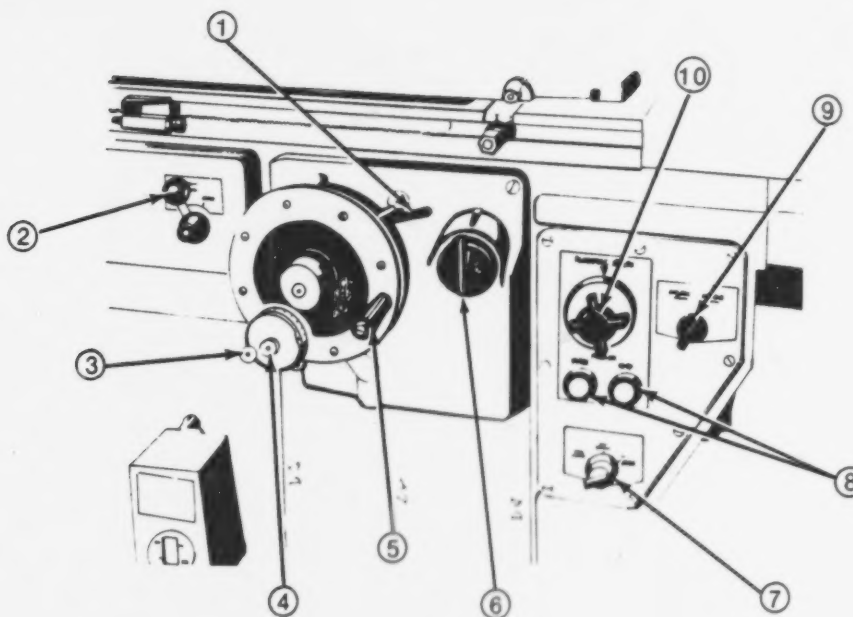


Used with permission of Brown and Sharpe Manufacturing Company.

LAP ASSIGNMENT SHEET #1

CONTROLS ON RIGHT FRONT OF MACHINE

- | | |
|---|---|
| ___ a. Switch operating slide throw-out lever | ___ f. Lever/handwheel selector switch |
| ___ b. Headstock speed control knob | ___ g. Cross-feed gear-shifting knob |
| ___ c. Machine start/stop push buttons | ___ h. Internal/external grinding selector knob |
| ___ d. Cross-feed handwheel | ___ i. Index plunger |
| ___ e. Disengagement knob | ___ j. Cross-feed control lever |

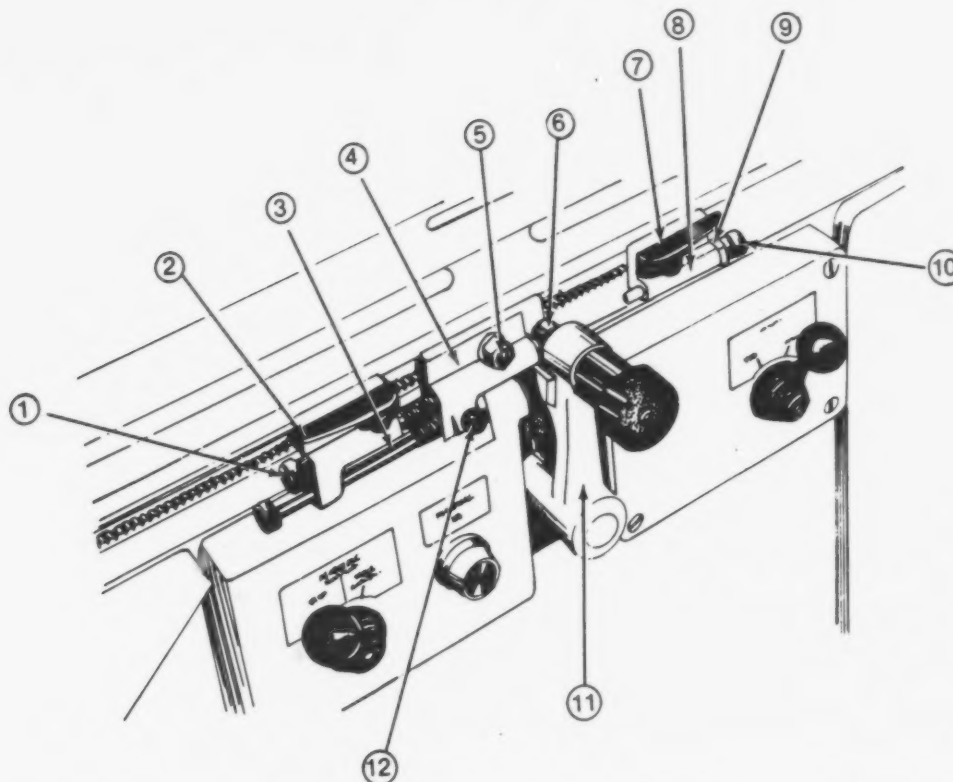


Used with permission of Brown and Sharpe Manufacturing Company.

LAP ASSIGNMENT SHEET #1

CONTROLS ON CENTER FRONT OF MACHINE

- | | |
|------------------------------------|------------------------------------|
| ___ a. Table-reversing lever | ___ g. Table stop clamp screw |
| ___ b. Table dog clamp bolt | ___ h. Table dog, left |
| ___ c. Adjusting screw knob, right | ___ i. Table dog pawl lever, right |
| ___ d. Table dog pawl lever, left | ___ j. Adjusting screw knob, left |
| ___ e. Reversing lever plunger | ___ k. Check nut |
| ___ f. Table stop adjustment screw | ___ l. Table dog, right |

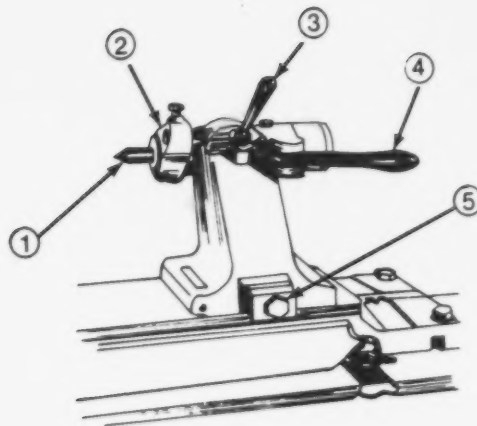


Used with permission of Brown and Sharpe Manufacturing Company.

LAP ASSIGNMENT SHEET #1

PARTS OF THE FOOTSTOCK

- | | |
|-------------------------------|-----------------------------------|
| _____ a. Center | _____ d. Footstock clamp and bolt |
| _____ b. Operating lever | _____ e. Spindle clamp handle |
| _____ c. Footstock dust guard | |

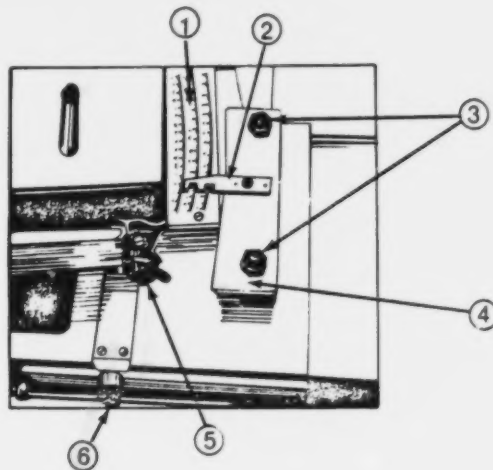


Used with permission of Brown and Sharpe Manufacturing Company.

LAP ASSIGNMENT SHEET #1

PARTS OF THE SWIVEL TABLE ADJUSTMENT

- | | |
|--------------------------|---------------------------|
| ___ a. Index finger | ___ d. Adjusting nut |
| ___ b. Table clamp | ___ e. Swivel table scale |
| ___ c. Table clamp bolts | ___ f. Locking-pin knob |



Used with permission of Brown and Sharpe Manufacturing Company.

12. Select from the list below to complete the following descriptions of the methods of applying coolants. Write the correct words in the blanks. Some blanks will contain more than one word.

Air
Wheel flanges

Nozzle

- a. FLOOD--Coolant is forced through piping to a _____ that directs coolant onto wheel at point of contact, thus washing wheel and cooling workpiece; coolant drains back into system and is filtered before being recycled
- b. MIST OR SPRAY--Small nozzle mixes coolant with _____; mixture is blown onto wheel and workpiece; helps clean wheel and cool workpiece, and provides for an unobstructed view of wheel and workpiece.

LAP ASSIGNMENT SHEET #1

- c. THROUGH-THE-WHEEL--Coolant is stored in _____;
holes drilled into wheel allow the wheel to absorb coolant to ensure
that coolant gets to the wheel/workpiece interface

13. Match grinding operation problems to their correct descriptions. Write the correct numbers in the blanks.

- | | |
|--|-----------------|
| _____ a. Areas on workpiece that have been allowed to heat excessively, causing them to expand and be ground off | 1. Feed lines |
| _____ b. Change in workpiece being ground caused by grinding heat; usually results in discoloration of surface | 2. Scratches |
| _____ c. Breaking up of a grinding wheel as a result of turning faster than its maximum safe operating speed or from being improperly stored | 3. Burning |
| _____ d. Excessive vibration of grinding wheel | 4. Explosion |
| _____ e. Unwanted pattern on workpiece resulting from slowing or stopping of grinding wheel due to excess pressure or friction | 5. Check marks |
| _____ f. Irregular marks left in surface of workpiece | 6. Chatter |
| _____ g. Pattern produced on workpiece as a result of table or workpiece movement | 7. Hollow spots |

14. Stop. Have your instructor evaluate your LAP assignment sheet and mark the area(s) below requiring additional study.

Refer to Information Sheet, Section(s)

- | | | | |
|-----------|------------|------------|-----------|
| _____ I | _____ VI | _____ X | _____ XVI |
| _____ II | _____ VII | _____ XI | |
| _____ III | _____ VIII | _____ XII | |
| _____ IV | _____ IX | _____ XIII | |

If none of the above study areas are checked, proceed to Learning Step 7. Otherwise, study the required section(s) of the Information Sheet and then continue to Learning Step 6.

GRINDING MACHINES
UNIT I--GRINDING MACHINES

LAP ASSIGNMENT SHEET #2

NAME _____ SCORE _____

1. Select from the list below to complete the following definitions of terms associated with grinding machines. Write the correct words in the blanks. Some blanks will contain more than one word.

rpm	Grinding wheel	Surface roughness	sfm
Pores	Black layer	Feet per minute	Solution
Cutting action	Abrasive stick	Weights	Dresser
Temperature	Dulling	Edge of metal	

- a. MEDIUM-- _____ used to carry or suspend abrasive particles during lapping operations; plural, media
- b. WORK SPEED--Rate at which workpiece or table traverse is moving; measured in _____
- c. WHEEL TRAVERSE SPEED--Rate of movement of _____ across workpiece
- d. SCALE-- _____ on surface of steel that has been heat-treated or formed hot; must be removed before grinding
- e. PROFILOMETER--Instrument for measuring the degree of _____ in microinches (0.000001 inch)
- f. OPERATING OR WHEEL SPEED--Speed of revolving grinding wheel expressed in revolutions per minute (_____) or surface feet per minute (_____)
- g. LOADED--Condition of grinding wheel in which the _____ are filled with material being ground; results in poor finish on workpiece and reduced cutting action of wheel
- h. HONING--Operation using bonded _____ in special holder to remove stock and produce a desired surface accuracy

LAP ASSIGNMENT SHEET #2

- i. GLAZING--_____ of cutting particles of grinding wheel; results in decreased cutting efficiency
 - j. GENERATED HEAT--Increased _____ of workpiece and wheel caused by friction of grinding
 - k. DRESSING--Process to improve or alter _____ of grinding wheel
 - l. BURR--Turned-over _____ caused by grinding operation
 - m. CUTTER--Part of grinding wheel _____ that comes into contact with wheel and does the dressing or shaping
 - n. BALANCING--Adding, subtracting, or positioning _____ on grinding wheel hub so that wheel weight will be evenly distributed
2. Select from the list below to complete the following statements concerning grinding machine operations. Write the correct words in the blanks. Some blanks will contain more than one word.

Loose abrasive grains
First

Final
Gates, fins, and spurs

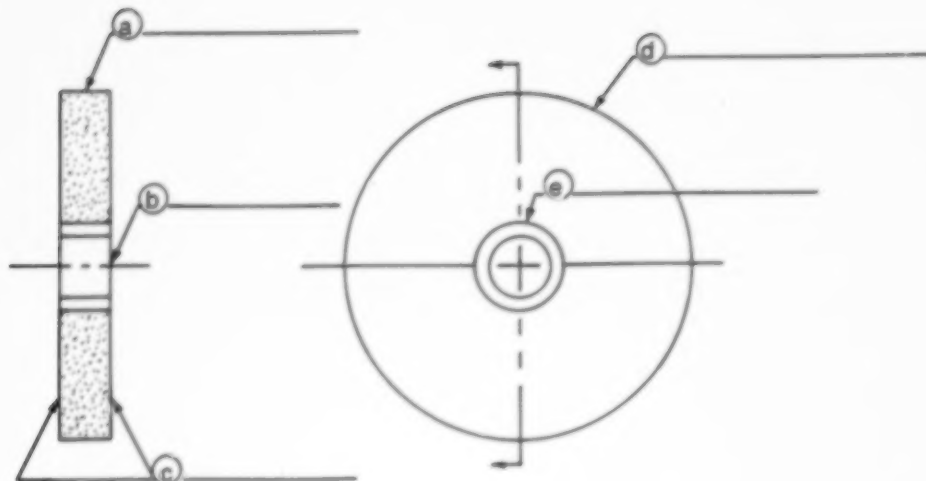
- a. SNAGGING--Process of grinding the _____ from castings
- b. FINISH GRINDING--_____ grinding operation to improve dimensional accuracy and obtain desired or near desired finish
- c. LAPPING--Finishing process that uses _____ carried by a medium to produce a desired surface finish
- d. ROUGH GRINDING--_____ grinding operation to reduce stock rapidly without particular regard to finish produced

LAP ASSIGNMENT SHEET #2

3. Identify the parts of the grinding wheel illustrated below. Write the correct names in the blanks.

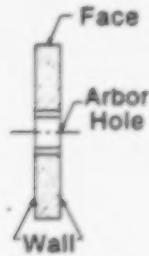
Arbor hole
Wall
Bushing

Periphery
Face

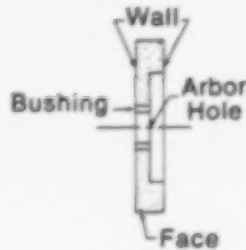


LAP ASSIGNMENT SHEET #2

4. Using the illustrations below, answer the following questions concerning grinding wheel types and their common applications.



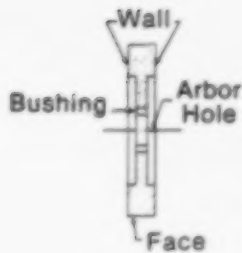
Type #1



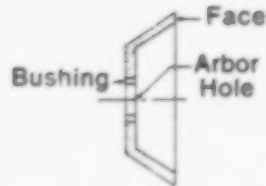
Type #5



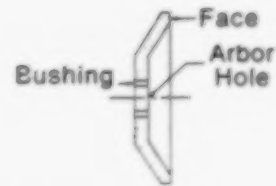
Type #6



Type #7



Type #11



Type #12

- a. Which grinding wheel types have straight wheels?
 - 1) _____
 - 2) _____
 - 3) _____
- b. What type has a straight-cup wheel and is used primarily for cutter grinding? _____
- c. Which type has a straight wheel recessed on one side? _____
- d. Which type has a straight wheel recessed on both sides? _____
- e. Which type has a dish wheel and permits grinding in narrow places?

- f. Which type has a flaring-cup wheel designed for side grinding?

LAP ASSIGNMENT SHEET #2

5. List reasons for truing and balancing grinding wheels.

- a. _____

- b. _____

- c. _____

- d. _____

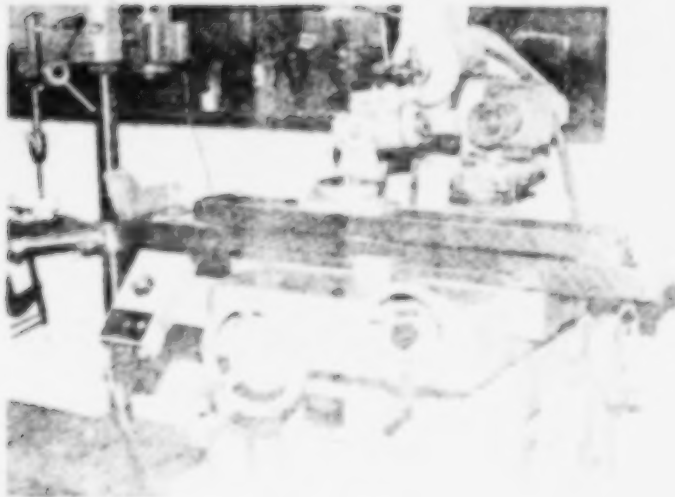
- e. _____

6. Label the types of abrasive cutting machines illustrated below. Write the correct names in the blanks.



- a. _____

LAP ASSIGNMENT SHEET #2

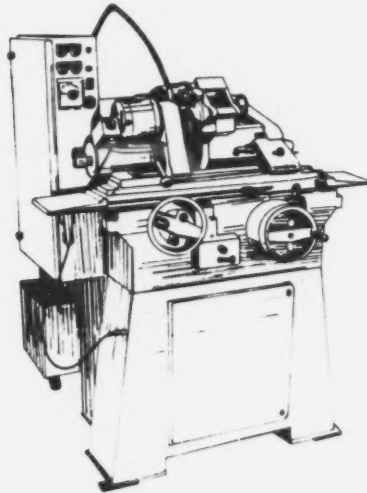


b. _____



c. _____

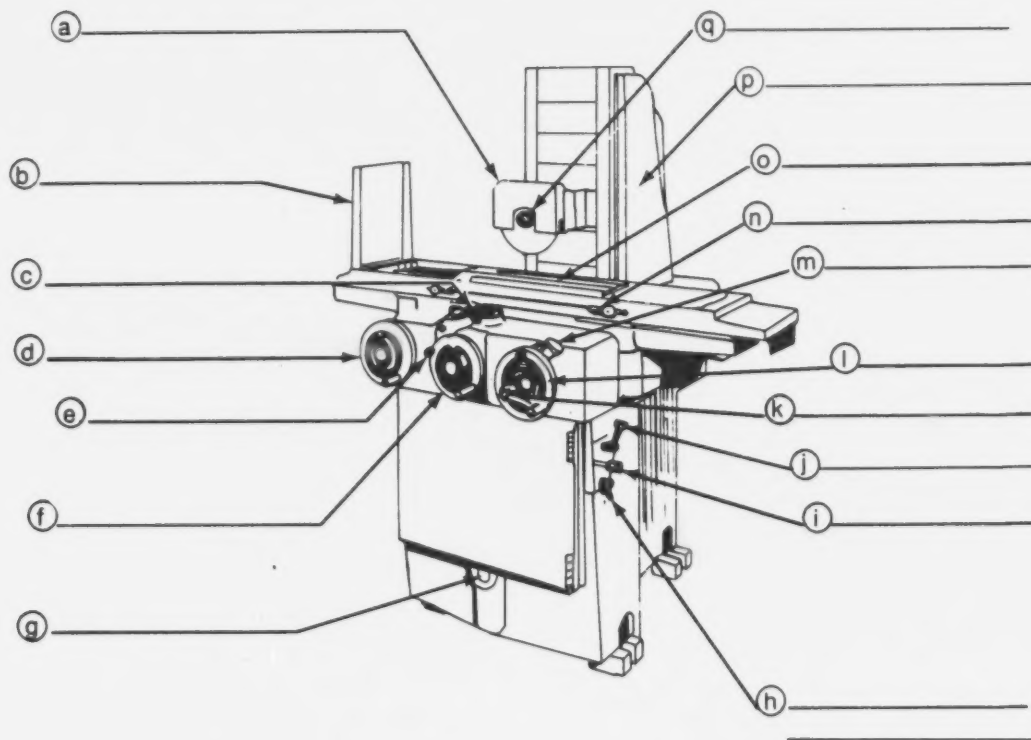
LAP ASSIGNMENT SHEET #2



Used with permission of Covell Manufacturing Company, Division of Clausing Corporation, Kalamazoo, Michigan.

d. _____

Dust deflector
Oil level sight glass
Cross-feed directional lever
Fine-feed adjustment knob
Table-reversing lever
Cross-feed handwheel
Upright
Fine-feed locknut
Spindle



LAP ASSIGNMENT SHEET #2

8. Match parts of a surface grinder to their correct functions. Write the correct numbers in the blanks. Functions continue on the next page.

- | | |
|---|---|
| _____ a. Moves table right or left | 1. Table-reversing lever |
| _____ b. Shields user from dust and chipped particles from wheel or workpiece | 2. Table handwheel |
| _____ c. When tightened, engages fine-feed adjustment knob; when loose, allows rapid movement by handwheels | 3. Elevating handwheel |
| _____ d. Helps control grinding dust and serves as protective guard in the event that grinding wheel explodes | 4. Cross-feed regulating screw |
| _____ e. Changes direction of table when moving right or left by power feed | 5. Fine-feed locknut |
| _____ f. Engages power-feed mechanism and allows upright to move in or out by power | 6. Oil level sight glass |
| _____ g. Regulates amount of step-over for each cut the wheel makes | 7. Wheel truing and rapid positioning lever |
| _____ h. Raises and lowers elevating mechanism of spindle; each graduation is 0.0002 inch | 8. Table dogs |
| _____ i. Aligns grinding wheel mounting hub and secures hub so that it will run true | 9. Upright |
| _____ j. Moves upright toward and away from table | 10. Cross-feed directional lever |
| _____ k. Provides a flat surface to which workpiece or work-holding devices are mounted | 11. Dial locknut |
| _____ l. Allows visual inspection of oil level | 12. Cross-feed handwheel |
| _____ m. Houses motor, spindle, and elevating mechanism; moves in and out on ways by means of cross-feed regulating screw | 13. Table |
| | 14. Wheel guard |
| | 15. Spindle |
| | 16. Dust deflector |
| | 17. Fine-feed adjustment knob |

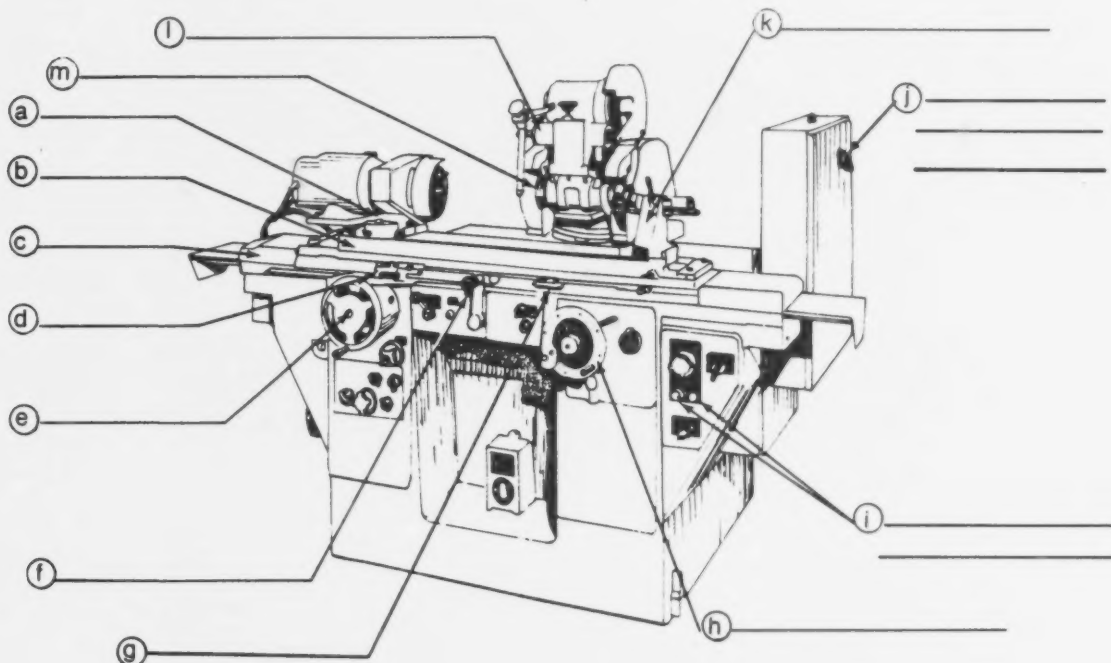
LAP ASSIGNMENT SHEET #2

- ____ n. Allows outer graduated ring of cross-feed or elevating wheel to be moved or set without moving feed mechanism
- ____ o. Regulate length of table travel by tripping table-reversing lever
- ____ p. Moves upright in and out, overrides the feed setting, and moves at a set rapid rate
- ____ q. Provides rapid movement of spindle up and down

9. Identify major parts of the cylindrical grinder illustrated below. Write the correct names in the blanks.

Cross-feed handwheel
Table handwheel
Table dog, left
Swivel table
Machine start/stop push buttons
External spindle
Table dog, right

Headstock
Sliding table
Table-reversing lever
Internal spindle
Footstock
Electrical control compartment



Used with permission of Brown and Sharpe Manufacturing Company.

LAP ASSIGNMENT SHEET #2

10. Match major parts of a cylindrical grinder to their correct functions. Write the correct numbers in the blanks.

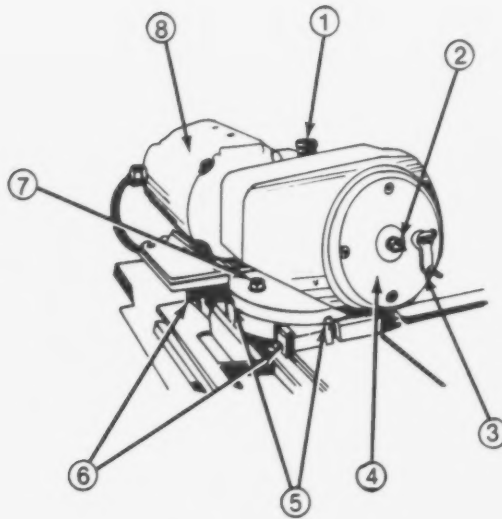
- | | |
|---|------------------------------------|
| _____ a. Supports workpiece and revolves workpiece at set surface feet per minute rate | 1. Electrical control compartment |
| _____ b. Holds internal quill and wheels for grinding | 2. Machine start/stop push buttons |
| _____ c. Moves upright in (toward table) or out (away from table) by manual feed | 3. Table dogs |
| _____ d. Main part of table; moves right and left by power or manual feed; carries swivel table | 4. Footstock |
| _____ e. Start external spindle and provide power to other controls | 5. External spindle |
| _____ f. Top part of sliding table; has T-slot for mounting work-holding devices or wheel dresser; adjustable to allow grinding of tapers | 6. Table handwheel |
| _____ g. Reverses direction of sliding table when table is under power feed | 7. Swivel table |
| _____ h. Moves sliding table right and left by manual feed | 8. Sliding table |
| _____ i. Regulate direction of table movement by striking table-reversing lever as table moves by power feed | 9. Table-reversing lever |
| _____ j. Holds workpiece when set up between centers | 10. Internal spindle |
| _____ k. Houses main power controls for all electrical components | 11. Headstock |
| _____ l. Holds wheel and wheel hub for external grinding | 12. Cross-feed handwheel |

LAP ASSIGNMENT SHEET #2

11. Identify selected controls and components of a cylindrical grinder. Write the correct numbers in the blanks.

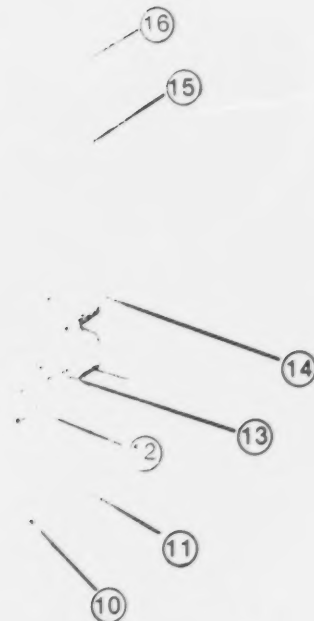
HEADSTOCK

- | | |
|------------------------------------|-------------------------------------|
| _____ a. Swivel clamp bolt (front) | _____ e. Spindle-locking plunger |
| _____ b. Index finger | _____ f. Work-driving arm |
| _____ c. Headstock motor | _____ g. Center |
| _____ d. Work-driving plate | _____ h. Headstock base clamp bolts |



Used with permission of Brown and Sharpe Manufacturing Company.

- External grinding spindle
- Wheel sleeve, right
- Wheel slide
- Wheel guard, left
- Motor sheave
- External grinding spindle motor
- Wheel slide water guard
- Universal turret

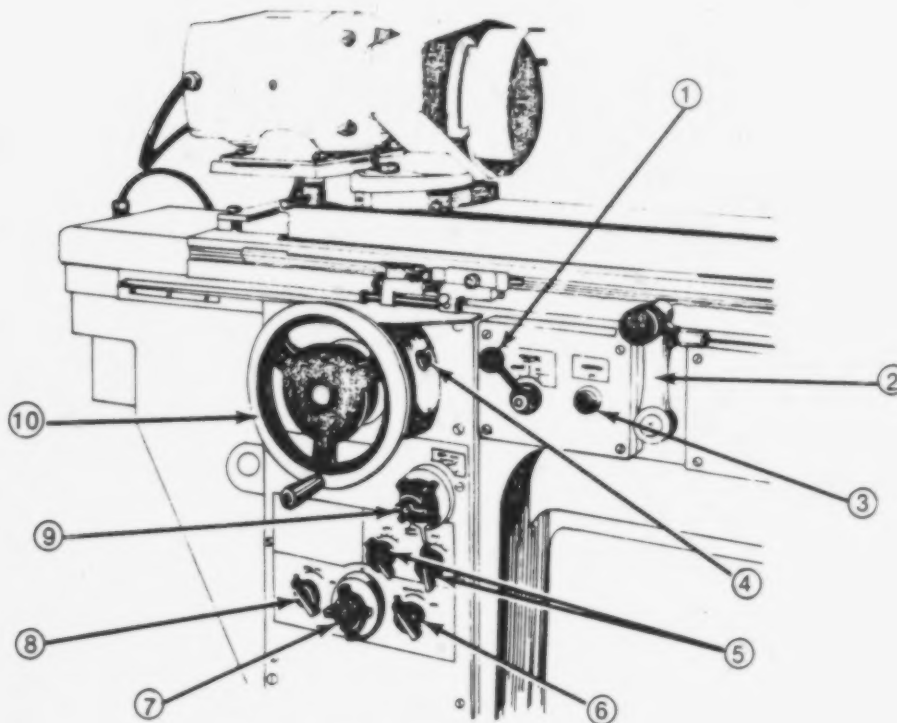


cturing Company.

LAP ASSIGNMENT SHEET #2

CONTROLS ON LEFT FRONT OF MACHINE

- | | |
|--|---|
| ___ a. Headstock and table control lever | ___ f. Handwheel shaft-locking plunger knob |
| ___ b. Feed, right on/off | ___ g. Table-reversing lever |
| ___ c. Table dwell switches | ___ h. Table speed selector knob |
| ___ d. Feed, left on/off | ___ i. Headstock jog button |
| ___ e. Table handwheel | ___ j. Amount of cross-feed knob |

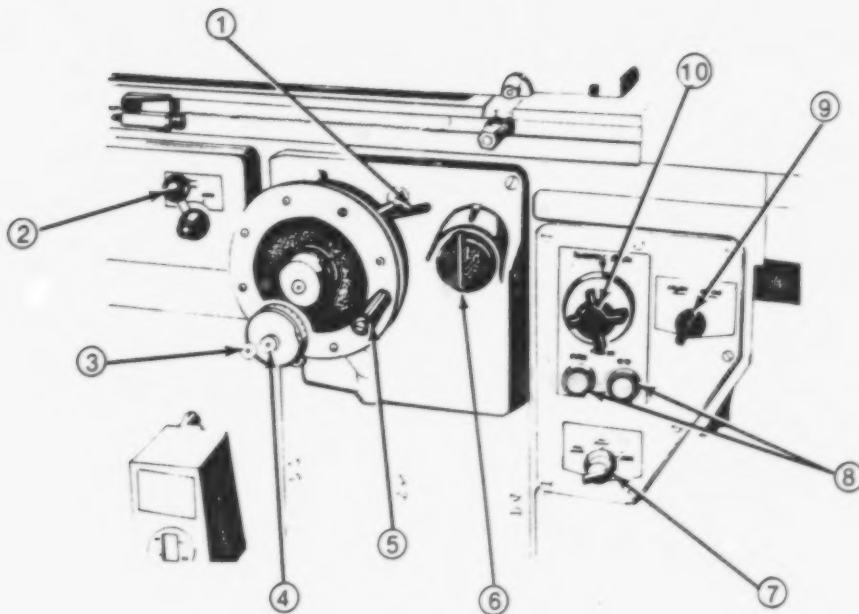


Used with permission of Brown and Sharpe Manufacturing Company.

LAP ASSIGNMENT SHEET #2

CONTROLS ON RIGHT FRONT OF MACHINE

- | | |
|---|---|
| ___ a. Switch operating slide throw-out lever | ___ f. Lever/handwheel selector switch |
| ___ b. Headstock speed control knob | ___ g. Cross-feed gear-shifting knob |
| ___ c. Machine start/stop push buttons | ___ h. Internal/external grinding selector knob |
| ___ d. Cross-feed handwheel | ___ i. Index plunger |
| ___ e. Disengagement knob | ___ j. Cross-feed control lever |

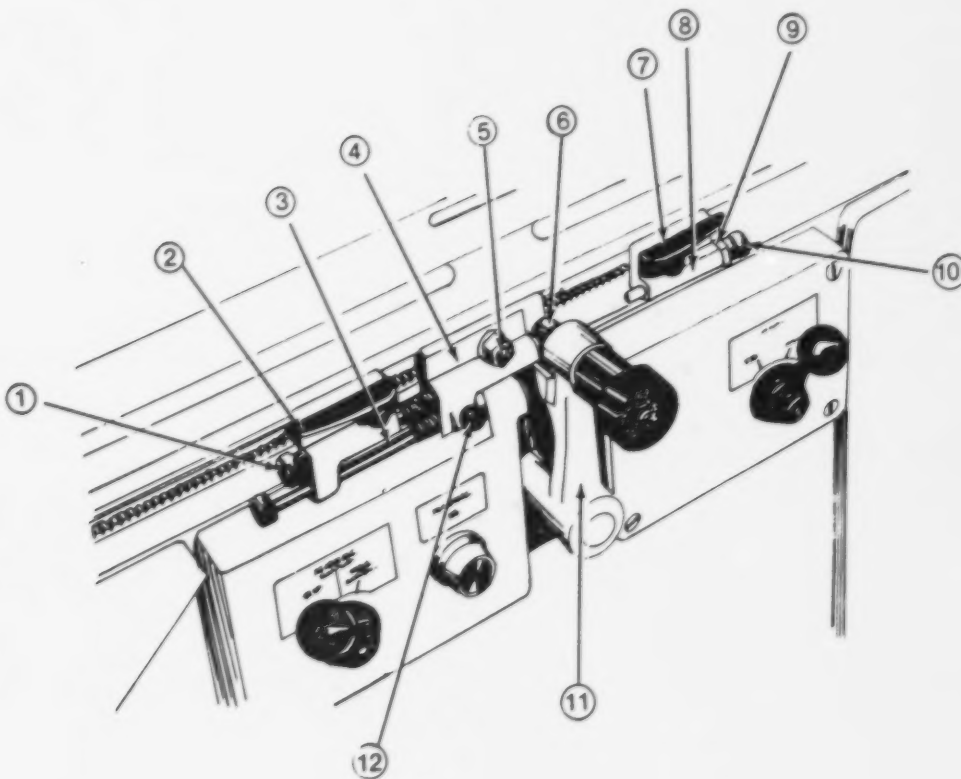


Used with permission of Brown and Sharpe Manufacturing Company.

LAP ASSIGNMENT SHEET #2

CONTROLS ON CENTER FRONT OF MACHINE

- | | |
|------------------------------------|------------------------------------|
| ___ a. Table-reversing lever | ___ g. Table stop clamp screw |
| ___ b. Table dog clamp bolt | ___ h. Table dog, left |
| ___ c. Adjusting screw knob, right | ___ i. Table dog pawl lever, right |
| ___ d. Table dog pawl lever, left | ___ j. Adjusting screw knob, left |
| ___ e. Reversing lever plunger | ___ k. Check nut. |
| ___ f. Table stop adjustment screw | ___ l. Table dog, right |

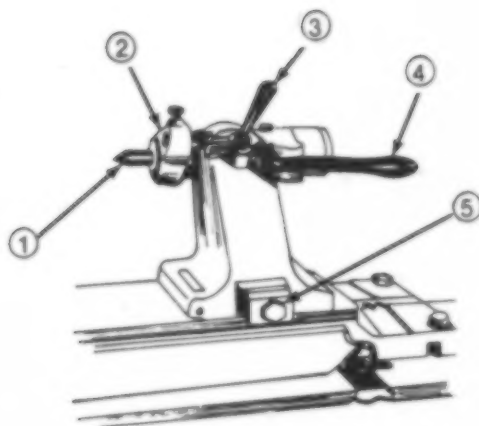


Used with permission of Brown and Sharpe Manufacturing Company.

LAP ASSIGNMENT SHEET #2

PARTS OF THE FOOTSTOCK

- | | |
|-------------------------------|-----------------------------------|
| _____ a. Center | _____ d. Footstock clamp and bolt |
| _____ b. Operating lever | _____ e. Spindle clamp handle |
| _____ c. Footstock dust guard | |

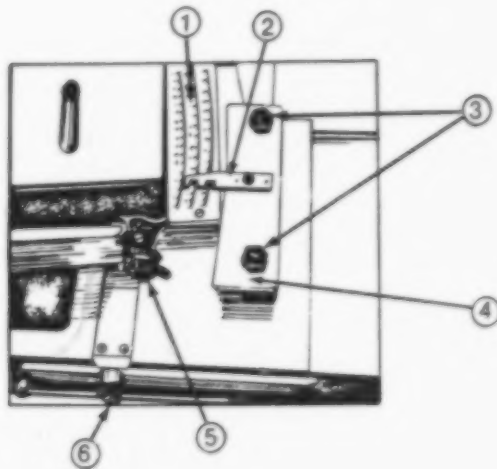


Used with permission of Brown and Sharpe Manufacturing Company.

LAP ASSIGNMENT SHEET #2

PARTS OF THE SWIVEL TABLE ADJUSTMENT

- | | |
|--------------------------|---------------------------|
| ___ a. Index finger | ___ d. Adjusting nut |
| ___ b. Table clamp | ___ e. Swivel table scale |
| ___ c. Table clamp bolts | ___ f. Locking-pin knob |



Used with permission of Brown and Sharpe Manufacturing Company.

12. Fill in the blanks to complete the following descriptions of methods of applying coolants.

- a. MIST OR SPRAY--Small nozzle mixes coolant with _____; mixture is blown onto wheel and workpiece; helps clean wheel and cool workpiece, and provides for an unobstructed view of wheel and workpiece.
- b. THROUGH-THE-WHEEL--Coolant is stored in _____; holes drilled into wheel allow the wheel to absorb coolant to ensure that coolant gets to the wheel/workpiece interface

LAP ASSIGNMENT SHEET #2

- c. FLOOD--Coolant is forced through piping to a _____ that directs coolant onto wheel at point of contact, thus washing wheel and cooling workpiece; coolant drains back into system and is filtered before being recycled.

13. Select from the list below to complete the following descriptions of grinding operation problems. Write the correct words in the blanks. Some blanks will contain more than one word.

Ground
Breaking up

Movement
Marks

Pressure or friction
Vibration

Heat

- a. CHATTER--Excessive _____ of grinding wheel
- b. BURNING--Change in workpiece being ground caused by grinding _____; usually results in discoloration of surface
- c. FEED LINES--Pattern produced on workpiece as a result of table or workpiece _____
- d. SCRATCHES--Irregular _____ left in surface of workpiece
- e. CHECK MARKS--Unwanted pattern on workpiece resulting from slowing or stopping of grinding wheel due to excess _____
- f. HOLLOW SPOTS--Areas on workpiece that have been allowed to heat excessively, causing them to expand and be _____ off
- g. EXPLOSION--_____ of a grinding wheel as a result of turning faster than its maximum safe operating speed or from being improperly stored

14. Stop. Have your instructor evaluate your LAP assignment sheet. If your instructor is satisfied with your progress, continue to Learning Step 7. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 7.

GRINDING MACHINES
UNIT I--GRINDING MACHINES

LAP ASSIGNMENT SHEET #3

NAME _____ SCORE _____

1. Identify grinding wheel compositions. Write the correct names in the blanks. Some blanks will contain more than one word.

Abrasive
Grade
Grain or grit

Bond
Structure

- a. _____ --Material in the grinding wheel that acts as the cutting agent; designated with numbers and letters, with the letters identifying the main base
- b. _____ --Material that holds abrasive together; designated by a letter or letters and/or numbers
- c. _____ --Size of abrasive expressed as a number from 10 (coarse) to 600 (very fine)
- d. _____ --Strength of the bond that holds wheel abrasives together; determines rate at which wheel will break down; designated by letters from A (soft) to Z (hard)
- e. _____ --Grain spacing designated by a number from 1 to 12; the higher the number, the more "open" the structure
2. Answer the following questions concerning grinding wheel composition.
- a. 1) What characteristic is designated by a number from 1 to 12?
- _____
- 2) What would the number "3" indicate?
- _____
- b. 1) What characteristic is designated by a letter from A to Z?
- _____

LAP ASSIGNMENT SHEET #3

2) What would the letter "W" indicate?

c. 1) What is the bonding characteristic of a grinding wheel?

2) How is the bond designated?

d. 1) How is the abrasive designated?

2) Which figures represent the abrasive in this grinding wheel:
76A120-G7V?

e. 1) What characteristic is designated by a number from 10 to 600?

2) What would the number 350 designate?

f. What is the range of the grade for each level of hardness? (Refer to Assignment Sheet #3, page GM-53.)

1) Soft: _____ through _____

2) Medium: _____ through _____

3) Hard: _____ through _____

g. What do the letters that designate bond type stand for?

1) B = _____

2) R = _____

3) E = _____

4) V = _____

LAP ASSIGNMENT SHEET #3

3. Interpret the following grinding wheel marking. Write the number/letters used to designate each composition element of grinding wheels. (Refer to Assignment Sheet #3, page GM-53.)

32A46-K8VBE

- a. Abrasive-- _____
 - b. Grit size-- _____
 - c. Grade-- _____
 - d. Structure-- _____
 - e. Bond type-- _____
 - f. Norton symbol-- _____
4. Stop. Have your instructor evaluate your LAP assignment sheet. If your instructor is satisfied with your progress, continue to Learning Step 11. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 11.

GRINDING MACHINES
UNIT I--GRINDING MACHINES

LAP ASSIGNMENT SHEET #4

NAME _____ SCORE _____

1. Fill in the blanks to complete statements concerning the possible causes of grinding operation problems. Some blanks will contain more than one word.

CHATTER

- a. Wheel out of _____
- b. Wheel out of _____
- c. Wheel too _____
- d. Wheel too _____
- e. Wheel improperly or poorly _____
- f. Misalignment of _____
- g. Work centers not _____
- h. Work centers damaged or not _____
- i. Work loose on _____

BURNT OR DISCOLORED FINISH

- a. Cutting pressure too _____
- b. No _____ (dry grinding)
- c. _____ coolant
- d. Coolant not properly _____
- e. Wrong _____ of coolant
- f. Wheel glazed or _____
- g. Wheel too _____
- h. Wheel too _____
- i. Improperly or poorly _____ wheel
- j. Table travel too _____

LAP ASSIGNMENT SHEET #4

FEED LINES

- a. Wheel too _____
- b. Wheel too _____
- c. _____ or poorly dressed wheel
- d. _____ wheel edge
- e. Improper travel or _____
- f. Worn spot in _____
- g. Misalignment of _____
- h. Coolant not properly _____

SCRATCHES

- a. Wheel too _____
- b. Wheel too _____
- c. Improperly or _____ dressed wheel
- d. _____ spots on face of wheel
- e. Ragged wheel _____
- f. _____ or loaded wheel
- g. Loose dirt from wheel _____
- h. _____ allowing abrasives to be pulled out
- i. _____ coolant
- j. Wrong _____ of coolant

SHORT AND LONG WAVE MARKS

- a. Wheel out of _____
- b. Wheel out of _____
- c. Internal machine _____
- d. Vibrations of _____

LAP ASSIGNMENT SHEET #4

- e. Cutting pressure too _____
- f. Wheel soaked from _____ on one side
- g. Work centers not _____
- h. Oil spots on _____ of wheel

SPIRALS

- a. Worn spot in _____
- b. Misalignment of _____
- c. Improperly or poorly _____ wheel
- d. Workpiece _____ on centers
- e. Table travel too _____
- f. Vibrations of _____
- g. Internal machine _____

CHECK MARKS

- a. Coolant not properly _____
- b. No _____ (dry grinding)
- c. _____ coolant
- d. _____ travel or work speed
- e. Cutting pressure too _____
- f. _____ or _____ wheel
- g. Wheel too _____

2. State the most frequent causes of grinding operation problems.

- a. _____
- b. _____

3. State six errors in the wheel that can cause grinding operation problems.

- a. _____
- b. _____

LAP ASSIGNMENT SHEET #4

- c. _____
- d. _____
- e. _____
- f. _____

4. State four causes for each of the following grinding operation problems.

CHATTER

- a. _____
- b. _____
- c. _____
- d. _____

BURNT OR DISCOLORED FINISH

- a. _____
- b. _____
- c. _____
- d. _____

FEED LINES

- a. _____
- b. _____
- c. _____
- d. _____

SCRATCHES

- a. _____
- b. _____
- c. _____
- d. _____

LAP ASSIGNMENT SHEET #4

SHORT AND LONG WAVE MARKS

- a. _____
- b. _____
- c. _____
- d. _____

SPIALS

- a. _____
- b. _____
- c. _____
- d. _____

CHECK MARKS

- a. _____
- b. _____
- c. _____
- d. _____

5. Stop. Have your instructor evaluate your LAP assignment sheet. If your instructor is satisfied with your progress, continue to Learning Step 15. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 15.

GRINDING MACHINES
UNIT I--GRINDING MACHINES

LAP ASSIGNMENT SHEET #5

NAME _____ SCORE _____

1. Fill in the blanks to complete statements concerning safety rules for operating grinding machines. Some blanks will contain more than one word.
 - a. WHEEL SELECTION--Use correct wheel for _____ and type of grinding being done
 - b. EYES--Wear approved _____ or approved eye protection when performing any type of grinding operation
 - c. GRINDING--Do not _____ work into wheel
 - d. GUARDS--Never operate grinding machines with safety guards _____
 - e. STARTING--Bring wheels that are at least 12 inches in diameter up to operating speed slowly by jogging _____ switches; allow wheel to run one minute before using
 - f. HANDS--Keep hands away from _____ wheel and workpiece during grinding
 - g. MOUNTING NUT--Tighten mounting nut only tight enough to keep wheel from _____; excessive tightening may crack wheel
 - h. RING TEST--Ring test all grinding wheels before _____
 - i. MOUNTING BLOTTERS--Use paper blotters on both sides of wheel so that pressure from _____ is evenly applied to sides of wheel
 - j. HANDLING--Handle all grinding wheels carefully; use rubber hose over _____ when handling large wheels

LAP ASSIGNMENT SHEET #5

- k. MOUNTING FLANGES--Use mounting flanges of correct _____ and those in good condition so that they apply even pressure to sides of wheel
 - l. STORING--Store all straight wheels _____; store cup, dish, and saucer wheels _____ with cardboard between layers
 - m. FORCE--Never force a grinding wheel on a machine _____
 - n. OPERATING SPEED--Never _____ manufacturer's maximum allowable operating speed of wheel
 - o. CENTERS--Lubricate center holes of workpiece with a compound other than _____ to prevent damage to centers
 - p. WET GRINDING--Turn off _____ and allow wheel to run several minutes to remove excess coolant
 - q. DRESSING--Tilt fixed dressing tools _____ degrees in direction of rotation and slightly _____ of or below center
 - r. WORK--Mount and secure workpiece properly; adjust workpiece between _____ carefully
 - s. TRIP DOGS--Set trip dogs with care to avoid contact between wheel and _____
2. Stop. Have your instructor evaluate your LAP assignment sheet. If your instructor is satisfied with your progress, continue to Learning Step 19. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 19.

GRINDING MACHINES
UNIT I--GRINDING MACHINES

ANSWERS TO PRETEST

- | | |
|---------|-------|
| 1. a. 4 | h. 6 |
| b. 7 | i. 10 |
| c. 2 | j. 9 |
| d. 8 | k. 13 |
| e. 3 | l. 11 |
| f. 1 | m. 14 |
| g. 5 | n. 12 |
-
- | | |
|---------|------|
| 2. a. 4 | c. 3 |
| b. 2 | d. 1 |
-
- | | |
|---------------|--------------|
| 3. a. Face | d. Periphery |
| b. Arbor hole | e. Bushing |
| c. Wall | |
-
- | | |
|----------------|------------|
| 4. a. Type #11 | d. Type #6 |
| b. Type #7 | e. Type #1 |
| c. Type #12 | f. Type #5 |
-
- | | |
|---------|------|
| 5. a. 2 | d. 5 |
| b. 1 | e. 4 |
| c. 3 | |
-
6. Answer should include any four of the following
- a. To make the wheel concentric with spindle of grinding machine
 - b. To eliminate chatter marks
 - c. To eliminate vibration

ANSWERS TO PRETEST

- d. To prevent wheel breakage
e. To prevent excessive bearing failure and damage to spindle
7. a. Internal/external grinder
b. Universal grinder
c. Universal and tool grinder
d. Surface grinder
8. a. Wheel guard
b. Dust deflector
c. Table-reversing lever
d. Table handwheel
e. Dial locknut
f. Cross-feed handwheel
g. Oil level sight glass
h. Wheel truing and rapid positioning lever
i. Cross-feed regulating screw
j. Cross-feed directional lever
k. Fine-feed locknut
l. Elevating handwheel
m. Fine-feed adjustment knob
n. Table dog
o. Table
p. Upright
q. Spindle
9. a. 15
b. 12
c. 9
d. 4
e. 10
f. 17
g. 3
h. 14
i. 11
j. 2
k. 13
l. 5
m. 7
n. 8
o. 16
p. 1
q. 6

ANSWERS TO PRETEST

10. a. Headstock h. Cross-feed handwheel
 b. Swivel table i. Machine start/stop push buttons
 c. Sliding table j. Electrical control compartment
 d. Table dog, left k. Footstock
 e. Table handwheel l. Internal spindle
 f. Table-reversing lever m. External spindle
 g. Table dog, right

11. a. 4 g. 3
 b. 10 h. 5
 c. 8 i. 7
 d. 11 j. 9
 e. 12 k. 6
 f. 2 l. 1

12. HEADSTOCK

- a. 2 d. 7 g. 8
 b. 5 e. 6 h. 1
 c. 3 f. 4

UPRIGHT

- a. 7 i. 11
 b. 12 j. 10
 c. 1 k. 15
 d. 8 l. 5
 e. 4 m. 9
 f. 14 n. 3
 g. 6 o. 13
 h. 16 p. 2

ANSWERS TO PRETEST

CONTROLS ON LEFT FRONT OF MACHINE

- | | |
|-------|------|
| a. 5 | f. 9 |
| b. 3 | g. 7 |
| c. 1 | h. 4 |
| d. 10 | i. 8 |
| e. 2 | j. 6 |

CONTROLS ON RIGHT FRONT OF MACHINE

- | | |
|------|-------|
| a. 2 | f. 4 |
| b. 3 | g. 5 |
| c. 6 | h. 10 |
| d. 1 | i. 8 |
| e. 7 | j. 9 |

CONTROLS ON CENTER FRONT OF MACHINE

- | | |
|-------|-------|
| a. 8 | g. 11 |
| b. 10 | h. 7 |
| c. 3 | i. 1 |
| d. 4 | j. 6 |
| e. 2 | k. 12 |
| f. 5 | l. 9 |

PARTS OF THE FOOTSTOCK

- | | |
|------|------|
| a. 1 | d. 4 |
| b. 3 | e. 5 |
| c. 2 | |

PARTS OF THE SWIVEL TABLE ADJUSTMENT

- | | |
|------|------|
| a. 6 | d. 1 |
| b. 5 | e. 3 |
| c. 4 | f. 2 |

ANSWERS TO PRETEST

13. a. 2
b. 3
c. 1

14. a. 4 e. 1
b. 2 f. 7
c. 6 g. 5
d. 3

15. CHATTER (Answer should include any six of the following)

- a. Wheel out of balance
- b. Wheel out of round
- c. Wheel too hard
- d. Wheel too fine
- e. Improperly or poorly dressed wheel
- f. Misalignment of centers
- g. Work centers not lubricated
- h. Work centers damaged or not true
- i. Work loose on centers

- BURNT OR DISCOLORED FINISH (Answers should include any six of the following)

- a. Cutting pressure too great
- b. No coolant (dry grinding)
- c. Insufficient coolant
- d. Coolant not properly applied
- e. Wrong type of coolant
- f. Glazed or loaded wheel

ANSWERS TO PRETEST

- g. Wheel too hard
- h. Wheel too fine
- i. Improperly or poorly dressed wheel
- j. Table travel too fast

FEED LINES (Answer should include any five of the following)

- a. Wheel too soft
- b. Wheel too coarse
- c. Improperly or poorly dressed wheel
- d. Ragged wheel edge
- e. Improper travel or work speed
- f. Worn spot in table ways
- g. Misalignment of centers
- h. Coolant not properly applied

SCRATCHES (Answer should include any six of the following)

- a. Wheel too coarse
- b. Wheel too soft
- c. Improperly or poorly dressed wheel
- d. Oil spots on face of wheel
- e. Ragged wheel edges
- f. Glazed or loaded wheel
- g. Loose dirt from wheel guard
- h. Bond allowing abrasives to be pulled out
- i. Dirty coolant
- j. Wrong type of coolant

ANSWERS TO PRETEST

SHORT AND LONG WAVE MARKS (Answer should include any five of the following)

- a. Wheel out of round
- b. Wheel out of balance
- c. Internal machine vibrations
- d. Vibrations of drive belt
- e. Cutting pressure too great
- f. Wheel soaked from coolant on one side
- g. Work centers not lubricated
- h. Oil spots on face of wheel

SPIRALS (Answer should include any five of the following)

- a. Worn spot in table ways
- b. Misalignment of centers
- c. Improperly or poorly dressed wheel
- d. Workpiece loose on centers
- e. Table travel too fast
- f. Vibrations of drive belt
- g. Internal machine vibrations

CHECK MARKS (Answer should include any five of the following)

- a. Coolant not properly applied
- b. No coolant (dry grinding)
- c. Insufficient coolant
- d. Improper travel or work speed
- e. Cutting pressure too great
- f. Glazed or loaded wheel
- g. Wheel too hard

ANSWERS TO PRETEST

16. Description should include the following

- a. Wear approved safety glasses or approved eye protection when performing any type of grinding operation
- b. Never operate grinding machines with safety guards removed
- c. Keep hands away from revolving wheel and workpiece during grinding
- d. Ring test all grinding wheels before mounting
- e. Handle all grinding wheels carefully; use rubber hose over hoist cables when handling large wheels
- f. Store all straight wheels upright; store cup, dish, and saucer wheels flat with cardboard between layers
- g. Never force a grinding wheel on a machine spindle
- h. Never exceed manufacturer's maximum allowable operating speed of wheel
- i. Use mounting flanges of correct diameter and those in good condition so that they apply even pressure to sides of wheel
- j. Use paper blotters on both sides of wheel so that pressure from flanges is evenly applied to sides of wheel
- k. Tighten mounting nut only tight enough to keep wheel from slipping; excessive tightening may crack wheel
- l. Bring wheels that are at least 12 inches in diameter up to operating speed slowly by jogging start/stop switches; allow wheel to run one minute before using
- m. Do not force work into wheel
- n. Use correct wheel for material and type of grinding being done
- o. Turn off coolant and allow wheel to run several minutes to remove excess coolant
- p. Mount and secure workpiece properly; adjust workpiece between centers carefully
- q. Set trip dogs with care to avoid contact between wheel and machine
- r. Tilt fixed dressing tools 3 degrees in direction of rotation and slightly left of or below center
- s. Lubricate center holes of workpiece with a compound other than lead to prevent damage to centers

GRINDING MACHINES
UNIT I--GRINDING MACHINES

ANSWERS TO LAP ASSIGNMENT SHEET #1

- | | | | |
|-------|----|----|----|
| 1. a. | 6 | h. | 12 |
| b. | 7 | i. | 13 |
| c. | 11 | j. | 5 |
| d. | 4 | k. | 8 |
| e. | 2 | l. | 14 |
| f. | 1 | m. | 3 |
| g. | 9 | n. | 10 |

2. a. Snagging
b. Finish grinding
c. Lapping
d. Rough grinding

- | | | | |
|-------|------------|----|-----------|
| 3. a. | Face | d. | Periphery |
| b. | Arbor hole | e. | Bushing |
| c. | Wall | | |

- | | | | |
|-------|----------|----|---------|
| 4. a. | Type #12 | d. | Type #7 |
| b. | Type #6 | e. | Type #5 |
| c. | Type #11 | f. | Type #1 |

- | | | | |
|-------|------------|----|------------------|
| 5. a. | Concentric | d. | Breakage |
| b. | Chatter | e. | Bearing, spindle |
| c. | Vibration | | |

ANSWERS TO LAP ASSIGNMENT SHEET #1

6. a. Internal/external grinder
b. Surface grinder
c. Universal grinder
d. Universal and tool grinder
7. a. Wheel guard
b. Dust deflector
c. Table-reversing lever
d. Table handwheel
e. Dial locknut
f. Cross-feed handwheel
g. Oil level sight glass
h. Wheel truing and rapid positioning lever
i. Cross-feed regulating screw
j. Cross-feed directional lever
k. Fine-feed locknut
l. Elevating handwheel
m. Fine-feed adjustment knob
n. Table dog
o. Table
p. Upright
q. Spindle
8. a. 1
b. 10
c. 11
d. 15
e. 9
f. 13
g. 14
h. 16
i. 5
j. 3
k. 2
l. 12
m. 8
n. 6
o. 17
p. 4
q. 7

ANSWERS TO LAP ASSIGNMENT SHEET #1

- | | |
|--------------------------|------------------------------------|
| 9. a. Headstock | h. Cross-feed handwheel |
| b. Swivel table | i. Machine start/stop push buttons |
| c. Sliding table | j. Electrical control compartment |
| d. Table dog, left | k. Footstock |
| e. Table handwheel | l. Internal spindle |
| f. Table-reversing lever | m. External spindle |
| g. Table dog, right | |

- | | |
|----------|-------|
| 10. a. 1 | g. 10 |
| b. 6 | h. 9 |
| c. 5 | i. 2 |
| d. 12 | j. 8 |
| e. 3 | k. 7 |
| f. 4 | l. 11 |

11. HEADSTOCK

- | | |
|------|------|
| a. 5 | e. 3 |
| b. 8 | f. 2 |
| c. 7 | g. 1 |
| d. 4 | h. 6 |

UPRIGHT

- | | | |
|-------|-------|-------|
| a. 16 | g. 3 | m. 14 |
| b. 2 | h. 1 | n. 12 |
| c. 7 | i. 13 | o. 15 |
| d. 10 | j. 6 | p. 8 |
| e. 9 | k. 11 | |
| f. 4 | l. 5 | |

ANSWERS TO LAP ASSIGNMENT SHEET #1

CONTROLS ON LEFT FRONT OF MACHINE

- | | |
|-------|------|
| a. 1 | f. 4 |
| b. 6 | g. 2 |
| c. 5 | h. 9 |
| d. 8 | i. 3 |
| e. 10 | j. 7 |

CONTROLS ON RIGHT FRONT OF MACHINE

- | | |
|-------|------|
| a. 1 | f. 7 |
| b. 10 | g. 6 |
| c. 8 | h. 9 |
| d. 5 | i. 3 |
| e. 4 | j. 2 |

CONTROLS ON CENTER FRONT OF MACHINE

- | | |
|-------|-------|
| a. 11 | g. 12 |
| b. 5 | h. 4 |
| c. 10 | i. 7 |
| d. 2 | j. 1 |
| e. 6 | k. 9 |
| f. 3 | l. 8 |

PARTS OF THE FOOTSTOCK

- | | |
|------|------|
| a. 1 | d. 5 |
| b. 4 | e. 3 |
| c. 2 | |

PARTS OF THE SWIVEL TABLE ADJUSTMENT

- | | |
|------|------|
| a. 2 | d. 6 |
| b. 4 | e. 1 |
| c. 3 | f. 5 |

ANSWERS TO LAP ASSIGNMENT SHEET #1

12. a. Nozzle
b. Air
c. Wheel flanges

- | | | | |
|--------|---|----|---|
| 13. a. | 7 | e. | 5 |
| b. | 3 | f. | 2 |
| c. | 4 | g. | 1 |
| d. | 6 | | |

GRINDING MACHINES
UNIT I--GRINDING MACHINES

ANSWERS TO LAP ASSIGNMENT SHEET #2

1. a. Solution h. Abrasive stick
b. Feet per minute i. Dulling
c. Grinding wheel j. Temperature
d. Black layer k. Cutting action
e. Surface roughness l. Edge of metal
f. rpm, sfm m. Dresser
g. Pores n. Weights
2. a. Gates, fins, and spurs
b. Final
c. Loose abrasive grains
d. First
3. a. Face d. Periphery
b. Arbor hole e. Bushing
c. Wall
4. a. 1) Type #1 3) Type #7
2) Type #5 4) Student may include Type #6
b. Type #6
c. Type #5
d. Type #7
e. Type #12
f. Type #11

ANSWERS TO LAP ASSIGNMENT SHEET #2

5.
 - a. To make the wheel concentric with spindle of grinding machine
 - b. To eliminate chatter marks
 - c. To eliminate vibration
 - d. To prevent wheel breakage
 - e. To prevent excessive bearing failure and damage to spindle

6.
 - a. Universal grinder
 - b. Universal and tool grinder
 - c. Surface grinder
 - d. Internal/external grinder

7.

a. Wheel guard	j. Cross-feed directional lever
b. Dust deflector	k. Fine-feed locknut
c. Table-reversing lever	l. Elevating handwheel
d. Table handwheel	m. Fine-feed adjustment knob
e. Dial locknut	n. Table dog
f. Cross-feed handwheel	o. Table
g. Oil level sight glass	p. Upright
h. Wheel truing and position- ing lever	q. Spindle
i. Cross-feed regulating screw	

8.

a. 2	g. 4	m. 9
b. 16	h. 17	n. 11
c. 5	i. 15	o. 8
d. 14	j. 12	p. 7
e. 1	k. 13	q. 3
f. 10	l. 6	

ANSWERS TO LAP ASSIGNMENT SHEET #2

- | | |
|--------------------------|------------------------------------|
| 9. a. Headstock | h. Cross-feed handwheel |
| b. Swivel table | i. Machine start/stop push buttons |
| c. Sliding table | j. Electrical control compartment |
| d. Table dog, left | k. Footstock |
| e. Table handwheel | l. Internal spindle |
| f. Table-reversing lever | m. External spindle |
| g. Table dog, right | |

- | | |
|-----------|------|
| 10. a. 11 | g. 9 |
| b. 10 | h. 6 |
| c. 12 | i. 3 |
| d. 8 | j. 4 |
| e. 2 | k. 1 |
| f. 7 | l. 5 |

11. HEADSTOCK

- | | |
|------|------|
| a. 7 | e. 1 |
| b. 5 | f. 3 |
| c. 8 | g. 2 |
| d. 4 | h. 6 |

UPRIGHT

- | | | |
|-------|-------|-------|
| a. 4 | g. 1 | m. 14 |
| b. 16 | h. 2 | n. 15 |
| c. 7 | i. 12 | o. 8 |
| d. 10 | j. 13 | p. 6 |
| e. 9 | k. 11 | |
| f. 3 | l. 5 | |

ANSWERS TO LAP ASSIGNMENT SHEET #2

CONTROLS ON LEFT FRONT OF MACHINE

- | | |
|-------|------|
| a. 1 | f. 4 |
| b. 6 | g. 2 |
| c. 5 | h. 9 |
| d. 8 | i. 3 |
| e. 10 | j. 7 |

CONTROLS ON RIGHT FRONT OF MACHINE

- | | |
|-------|------|
| a. 1 | f. 7 |
| b. 10 | g. 6 |
| c. 8 | h. 9 |
| d. 5 | i. 3 |
| e. 4 | j. 2 |

CONTROLS ON CENTER FRONT OF MACHINE

- | | |
|-------|-------|
| a. 11 | g. 12 |
| b. 5 | h. 4 |
| c. 10 | i. 7 |
| d. 2 | j. 1 |
| e. 6 | k. 9 |
| f. 3 | l. 8 |

PARTS OF THE FOOTSTOCK

- | | |
|------|------|
| a. 1 | d. 5 |
| b. 4 | e. 3 |
| c. 2 | |

PARTS OF THE SWIVEL TABLE ADJUSTMENT

- | | |
|------|------|
| a. 2 | d. 6 |
| b. 4 | e. 1 |
| c. 3 | f. 5 |

ANSWERS TO LAP ASSIGNMENT SHEET #2

12. a. Air
b. Wheel flanges
c. Nozzle
13. a. Vibration
b. Heat
c. Movement
d. Marks
e. Pressure or friction
f. Ground
g. Breaking up

GRINDING MACHINES
UNIT I--GRINDING MACHINES

ANSWERS TO LAP ASSIGNMENT SHEET #3

1. a. Abrasive
b. Bond
c. Grain or grit
d. Grade
e. Structure
2. a. 1) Structure
2) Abrasives are close to each other
b. 1) Grade
2) Hard
c. 1) Material that holds abrasive together
2) A letter or letters and/or numbers
d. 1) Numbers and letters, with letters identifying the main base
2) 76A
e. 1) Grain or grit
2) Very fine
f. 1) A through H
2) I through P
3) Q through Z
g. 1) Resinoid 3) Shellac
2) Rubber 4) Vitrified
3. a. 32A
b. 46
c. K
d. 8
e. V
f. BE

GRINDING MACHINES
UNIT I--GRINDING MACHINES

ANSWERS TO LAP ASSIGNMENT SHEET #4

1. CHATTER

- | | |
|------------|---------------|
| a. Balance | f. Centers |
| b. Round | g. Lubricated |
| c. Hard | h. True |
| d. Fine | i. Centers |
| e. Dressed | |

BURNT OR DISCOLORED FINISH

- | | |
|-----------------|------------|
| a. Great | f. Loaded |
| b. Coolant | g. Hard |
| c. Insufficient | h. Fine |
| d. Applied | i. Dressed |
| e. Type | j. Fast |

FEED LINES

- | | |
|---------------|---------------|
| a. Soft | e. Work speed |
| b. Coarse | f. Table ways |
| c. Improperly | g. Centers |
| d. Ragged | h. Applied |

SCRATCHES

- | | |
|-----------|-----------|
| a. Coarse | f. Glazed |
| b. Soft | g. Guard |
| c. Poorly | h. Bond |
| d. Oil | i. Dirty |
| e. Edges | j. Type |

ANSWERS TO LAP ASSIGNMENT SHEET #4

SHORT AND LONG WAVE MARKS

- | | |
|---------------|---------------|
| a. Round | e. Great |
| b. Balance | f. Coolant |
| c. Vibrations | g. Lubricated |
| d. Drive belt | h. Face |

SPIRALS

- | | |
|---------------|---------------|
| a. Table ways | e. Fast |
| b. Centers | f. Drive belt |
| c. Dressed | g. Vibrations |
| d. Loose | |

CHECK MARKS

- | | |
|-----------------|-------------------|
| a. Applied | e. Great |
| b. Coolant | f. Glazed, loaded |
| c. Insufficient | g. Hard |
| d. Improper | |

2. a. Wrong type of wheel
b. Improperly or poorly dressed wheel

3. Answer should include any six of the following

- | | |
|-------------------|---------------------------------|
| a. Out of round | f. Too soft |
| b. Out of balance | g. Improperly or poorly dressed |
| c. Too coarse | h. Ragged wheel edge |
| d. Too fine | i. Oil spots on wheel |
| e. Too hard | |

ANSWERS TO LAP ASSIGNMENT SHEET #4

4. CHATTER (Answer should include any four of the following)

- a. Wheel out of balance
- b. Wheel out of round
- c. Wheel too hard
- d. Wheel too fine
- e. Improperly or poorly dressed wheel
- f. Misalignment of centers
- g. Work centers not lubricated
- h. Work centers damaged or not true
- i. Work loose on centers

BURNT OR DISCOLORED FINISH (Answer should include any four of the following)

- a. Cutting pressure too great
- b. No coolant (dry grinding)
- c. Insufficient coolant
- d. Coolant not properly applied
- e. Wrong type of coolant
- f. Glazed or loaded wheel
- g. Wheel too hard
- h. Wheel too fine
- i. Improperly or poorly dressed wheel
- j. Table travel too fast

FEED LINES (Answer should include any four of the following)

- a. Wheel too soft
- b. Wheel too coarse
- c. Improperly or poorly dressed wheel
- d. Ragged wheel edge

ANSWERS TO LAP ASSIGNMENT SHEET #4

- e. Improper travel or work speed
- f. Worn spot in table ways
- g. Misalignment of centers
- h. Coolant not properly applied

SCRATCHES (Answer should include any four of the following)

- a. Wheel too coarse
- b. Wheel too soft
- c. Improperly or poorly dressed wheel
- d. Oil spots on face of wheel
- e. Ragged wheel edges
- f. Glazed or loaded wheel
- g. Loose dirt from wheel guard
- h. Bond allowing abrasives to be pulled out
- i. Dirty coolant
- j. Wrong type of coolant

SHORT AND LONG WAVE MARKS (Answer should include any four of the following)

- a. Wheel out of round
- b. Wheel out of balance
- c. Internal machine vibrations
- d. Vibrations of drive belt
- e. Cutting pressure too great
- f. Wheel soaked from coolant on one side
- g. Work centers not lubricated
- h. Oil spots on face of wheel

ANSWERS TO LAP ASSIGNMENT SHEET #4

SPIRALS (Answer should include any four of the following)

- a. Worn spot in table ways
- b. Misalignment of centers
- c. Improperly or poorly dressed wheel
- d. Workpiece loose on centers
- e. Table travel too fast
- f. Vibrations of drive belt
- g. Internal machine vibrations

CHECK MARKS (Answer should include any four of the following)

- a. Coolant not properly applied
- b. No coolant (dry grinding)
- c. Insufficient coolant
- d. Improper travel or work speed
- e. Glazed or loaded wheel
- f. Wheel too hard

GRINDING MACHINES
UNIT I--GRINDING MACHINES

ANSWERS TO LAP ASSIGNMENT SHEET #5

- | | |
|-------------------|------------------|
| 1. a. Material | k. Diameter |
| b. Safety glasses | l. Upright, flat |
| c. Force | m. Spindle |
| d. Removed | n. Exceed |
| e. Start/stop | o. Lead |
| f. Revolving | p. Coolant |
| g. Slipping | q. 3, left |
| h. Mounting | r. Centers |
| i. Flanges | s. Machine |
| j. Hoist cables | |